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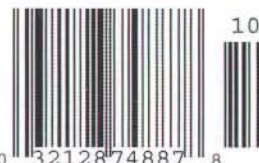
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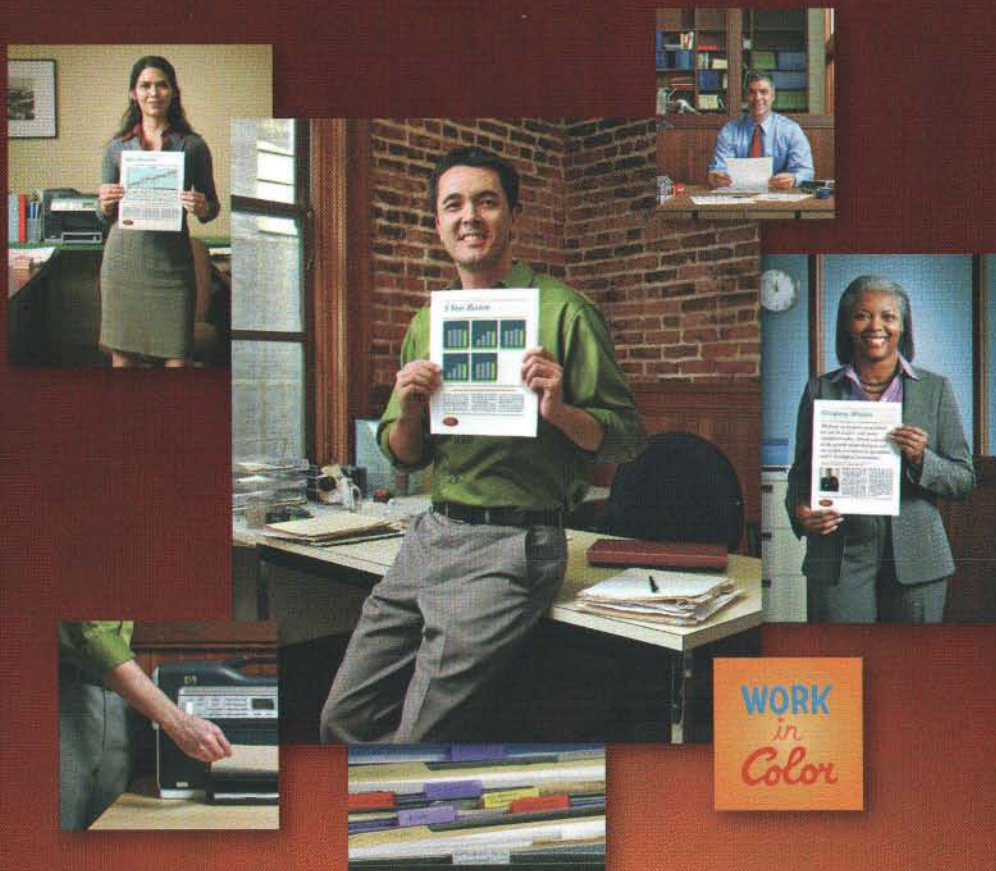
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Patrick Emerson

From: Patrick Emerson [pemerson@yourc
Sent: Tuesday, March 11, 2008 1:38 PM
To: Michael Allen
Subject: Moving to a Subscription Based Sales Model

Mike,

I've run the numbers and I really think we should recommend a subscription model to Steve. With our product, it's a financial win and now allows us to easily monetize our support services. Add in the fact our customers will benefit with more choice on how to purchase our product...it's a no-brainer.

Thoughts?

- Patrick

----- Michael Allen Replied -----

From: Michael Allen [mallen@yourcompany.com]
Sent: Tuesday, March 11, 2008 1:42 PM
To: Patrick Emerson
Subject: Re: Moving to a Subscription Based Sales Model

Patrick,

Yes, I agree it makes great financial sense. Here's the thing, we have to build it. This means new code in our product, new UI in our store, and managing end-user's in a whole new way. Not to mention, the compliance, legal and financial complications we will now have. Don't we also have to address all new requirements and security concerns when we save personal information and recharge someone's credit card?

I'm not sure we have the time or resources for all of that or even fully understand it. Still, I would hate to let this slide.

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From the Editor

October is absolutely one of my favorite months. Clearly autumn, it provides the ability to go outdoors without freezing, but respite and reasoning to stay indoors...perhaps in front of the computer, practicing your craft? This month's MacTech gives you opportunity to do just that.

If you are a System Administrator, check out Greg Neagle's writing for MacEnterprise this month. FileVault is a fact of life for many, and you'll most likely have to move a FileVaulted home at some point. Greg shows you how in "Migrating FileVault." (As an aside, if in fact, you are a System Administrator, read every column from Greg, practice the teachings and make sure you can do it on your own! That will lead to OS X mastery).

This month's Mac in the Shell brings you further, more advanced ways to customize the bash shell to make your life easier. Since most users keep the default bash shell for day-to-day operation, it's worthwhile becoming familiar with the more esoteric tips to help you navigate your way.

Now that Apple's v10.5 ACSA path is set, Doug Hanley returns and leads you through the requirements of obtaining Apple's highest certification. For anyone considering this path, let Doug be your guide.

Jose Cruz continues to give us the inside scoop on PackageMaker – an important tool for System Administrators and Developers alike. This month, learn the tricks to packaging and distributing kernel extensions and other "special" file types.

Mihalis Tsoukalos brings us a good example of how to create a Dashboard Widget that can store its preferences, set on the back side, and use them next launch.

Finally, the MacTech Spotlight has a conversation with Matthew Drayton from Nolo. Nolo is known for the popular file transfer client Interarchy, but has also begun to ship Iris, an image editor. Coincidentally – or not – Interarchy has long been my GUI client of choice, and it's nice to see it continue in dedicated hands.

Read, enjoy, and send us feedback! See you next month.

**Ed Marczak,
Executive Editor**



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The Road To Certification: Revisited

Increase your knowledge and build credibility on the way

by Doug Hanley

Introduction

In a previous series of articles, we looked at Apple's IT certifications and hardware certifications. We examined reasons for and benefits of getting certified, as well as the testing experience and the changes Apple made to its IT certifications with the release of Mac OS X Leopard. We looked at the new Macintosh Technician certification, designed for technicians at Apple Authorized Service Providers, as well as Apple's Pro Apps certifications for Final Cut Studio and Logic Studio. While we did cover the new Apple Certified System Administrator (ACSA) 10.5 certification, we were not able to look as deeply into the topics covered on each of the exams required for ACSA certification and what resources are available to help you prepare for them. Those resources are finally available including Apple Authorized Training Center classes and books. We will also discuss upcoming Snow Leopard Certification, which should be available after its release next year.

Apple Certified System Administrator

Apple Certified System Administrator (ACSA) is Apple's highest IT certification. An ACSA is recognized as having an in-depth knowledge of Mac OS X's technical architecture, and the ability to design and maintain networks. An ACSA should be able to enable, customize, tune and integrate Mac OS X, Mac OS X Server and other Apple technologies within a multi-platform environment.

ACSA certification has undergone a few changes over the years. When the certification first launched for Mac OS X 10.2, it required passing two exams that were based on concepts covered in two five-day classes – one focused on client and one on server. With Tiger (Mac OS X 10.4) it became a credit-based system with a minimum of 7 current

credits required to be an ACSA. Now with Leopard (Mac OS X 10.5), there has been a change that I believe is for the better. To achieve ACSA 10.5, you now need to pass four exams: Server Essentials, Directory Services, Deployment, and Advanced System Administration. I feel this is a more challenging and rewarding certification. In this article, I will tell you about the courses and books available to help prepare for those exams.

Preparing for the Exams

The best way to prepare for any of the ACSA exams is to take the associated class at an Apple Authorized Training Center (AATC). You can find the nearest AATC at: <http://training.apple.com/locations>. You could also prepare by reviewing the Apple Training Series book published by Peachpit for the particular course, but you will be more thoroughly prepared by participating in a class. The classes are a combination of lectures and hands-on exercises designed to reinforce the concepts covered in the course. All of the exams are now available as well as the associate books and courses. Also available are the Skills Assessment Guides and Sample Tests, which can be downloaded as PDFs at:

<http://training.apple.com/certification/acsa>

Directory Services

In January's issue we discussed in detail what is involved in the Server Essentials course. Now we will look at the other three areas of study: Directory Services, Deployment, and Advanced System Administration.

In the four-day Mac OS X Directory Services v10.5 (Leopard 301) course, students learn how to effectively configure Mac OS X computers to access directory services, and how to configure Mac OS X Server to provide directory

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services in a mixed-platform environment. The course itself focuses on both Mac OS X as a directory service client, and Mac OS X Server as a directory server. Cross platform solutions will be emphasized in both instances. Students using Mac OS X learn how to use network accounts and Kerberos authentication with any common directory service, such as Apple's Open Directory, Microsoft's Active Directory, or an industry-standard LDAP server. In working with Mac OS X Server, students learn how to run a robust, scalable directory system using Apple's Open Directory service. Students also learn how to use Mac OS X Server to augment an existing directory service infrastructure.

The following is an overview of how your time will be spent in the class. You begin by examining the Local Directory Service, and move on to accessing an Open Directory System. Open Directory is the LDAP directory service model implementation from Apple. You will learn how to properly bind to an Open Directory Server and troubleshoot authentication issues. The class then covers working with 3rd party LDAP servers, including Active Directory from Microsoft because it is important to learn the different ways you can integrate your Mac clients into other directory systems. By the third day, you are configuring your own Open Directory system and learning how to distribute the load through replicas of your system. Finally by the fourth day, you are connecting your server into Open Directory and other directory systems. All along the way, you are learning more about the underlying services and processes involved.

Having a solid understanding of directory services and how they are implemented and integrated in Mac OS X is crucial to deploying multiple servers offering varying services all tied to the same directory structure. You will need this deeper understanding if you want to move beyond stand-alone deployments of Mac OS X Server.

The reference guide used in the class is Apple Training Series: Mac OS X Directory Services v10.5, by Arek Dreyer (ISBN: 978-0321509734).

Deployment

Speaking of Deployment, there has to be a better way to install the operating system and software on multiple machines on your network than using a DVD or CD, right? Well that is exactly what is covered in the three-day Mac OS X Deployment v10.5 (Leopard 302) course. The first section of the course focuses on solutions for deploying software, ranging from individual files to complete system images to multiple machines. Students get hands-on experience using tools such as Apple Remote Desktop, Disk Utility, PackageMaker, and System Image Utility, and leave knowing the pros and cons of various deployment solutions. In the second section of the course, students apply what they have learned and create a full deployment plan that includes testing, deployment, auditing, and maintenance. How to create a multi-tiered Software Update Server, and third party

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solutions are also discussed to augment your deployment plan.

One of the key concepts covered in this course are modular images. Currently, many large institutions, especially school districts do what can be referred to as monolithic imaging. In other words, they build and install everything needed on one machine and image it. Then they deploy that image. Modular imaging allows you to update parts without having to go through the entire install processes again. This has become a critical strategy for Mac OS 10.5 Leopard. Even a Leopard client machine has a local KDC, or a Kerberos key distribution center. You will run into many problems if you clone and deploy monolithic images because you now have a number of machines which all think they are the same local KDC. Because of this, you may decide the modular imaging section alone is worth the cost of the class.

The reference guide used in the class is Apple Training Series: Mac OS X Deployment v10.5, by Kevin White (ISBN: 978-0321502681).

Advanced System Administration

The Mac OS X Advanced System Administration v10.5 (Leopard 401) course builds on the foundations established in the Support Essentials and Server Essentials courses, and is designed to empower students to meet the challenges faced by administrators deploying Mac OS X Server in today's complex and dynamic data centers. This challenging five-day course equips students with in-depth and practical skills in Mac OS X technology. The course's task-based focus enhances the learning process through the use of practical examples in a relevant context.

Tasks are organized into several key knowledge domains: implementation, networking, administration, and optimization. Implementation tasks focus on aspects of installing, upgrading, configuring, and migrating existing legacy systems to more recent versions and configurations. Networking tasks concentrate on establishing solid foundations for network services, as well as connecting private and public networks securely. Students gain experience with monitoring tools and automation technologies that form the core of the administration tasks necessary to effectively administer large deployments on a daily basis. An exploration of tools and techniques relating to performance-based tasks such as optimizing services, scaling systems, and establishing high availability of services, data, and components, helps build students' confidence in their administration skills. The course concludes with vital maintenance tasks that address aspects of maintaining a system's availability and preserving the integrity of critical data.

If you are not comfortable with the command line, I strongly suggest you become familiar with it ahead of time. There is a great deal of typing required, however you do learn the underlying systems and procedures hidden behind

the GUI of Mac OS X. You will definitely learn how to harness the power of UNIX in Mac OS X. The extensive use of the command line interface reveals a deeper scope of the course's subject material and prepares students to become more efficient by taking advantage of the wide variety of automation technologies built into Mac OS X and Mac OS X Server. This is a long, but worthwhile class. Combined with the other ACSA classes, the depth of knowledge and experience you will gain in supporting a Mac OS X-based network is priceless.

The reference guide used in this class is *Apple Training Series: Mac OS X Advanced System Administration* by Edward Marczak (ISBN: 978-0321563149).

Hitting the Road

Having sat through the instructor preparations for the Leopard courses, I am very excited about the quality of the ACSA level classes. I strongly recommend taking courses at an AATC, where you not only get hands-on experience and access to the additional materials, but also the valuable expertise of an Apple Certified Trainer and your industry peers. The other advantage is that you have access to enough computers to implement the exercises and test new ideas in a safe environment. The best trainers are the ones who actually do this type of integration in the real world. I suggest you use these criteria as you select a trainer and training center.

The Near Future of Apple Certification

Certification is a journey, and for Mac OS X, the journey continues with each new release of Mac OS X. It was announced at WWDC 2008 that Snow Leopard (expected to be Mac OS X version 10.6) will be released next year, although we don't know when exactly. One of the unique features of Snow Leopard is that the focus is less about new features and more about refinement and stability of the operating system. If you already hold a Leopard certification for ACTC or ACSA, there will only be an Update Exam for each. This creates a strong incentive to achieve your ACSA sooner than later, especially if you have started on the path.

More information about ACSA certification, classes and other preparatory materials is available on Apple's training & certification website:

<http://training.apple.com/certification/acsa>



About The Author

Doug Hanley owns MacTEK Consulting & Training, an Apple Authorized Training Center in Las Vegas, NV. His time is divided between teaching classes and wrangling servers. He has been providing support on the Mac since the early 90's. To track him down, go to <http://www.mactektraining.com> or email doug@mactek.com



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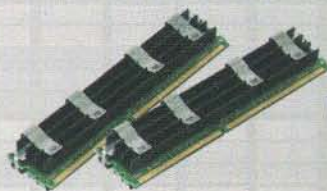
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MAC IN THE SHELL

by Edward Marczak

Customizing the bash Experience Further

Changing the bash shell to suit your needs.

Introduction

Last month, I launched into a different kind of introduction to bash. It concerns making you, the end user, comfortable and efficient. This month wraps up this topic with a look at more ways to wring magic out of bash.

History

For once, I'm not talking about "history" as in a "history lesson." This time, I'm talking about *history* in bash. bash history is both a command, and a function of the bash shell. bash very nicely will keep history (a log, or journal) of the commands you execute. Open up a shell (probably using Terminal.app), and type `ls -l`. Now, change into the `/Users/Shared` directory using the `cd` command: `cd /Users/Shared`. From here, press the up arrow on your keyboard. The current input line should recall the previous command (`cd /Users/Shared`). Pressing the up arrow again will recall the command before that. Do so, and when "`ls -l`" appears, press the return key to execute the `ls` command and list the contents of the directory you're currently in. Now, type `history`, and press return. You should see a list of commands previously executed, ending with "`ls -l`", "`cd /Users/Shared`" and another "`ls -l`".

The simple fact that we can scroll through our session's history with the up and down arrow, and retrieve an entire listing is pretty amazing all on its own. Not surprisingly, it gets better!

First, let's make sure we capture all of the history we want. There are several shell variables that configure the behavior of bash history. Here's what I use in my `~/.bash_profile`:

```
export HISTSIZE=12000
export HISTFILESIZE=12000
export HISTCONTROL='ignoreboth'
export HISTTIMEFORMAT='%b %d %H:%M:%S: '
```

(there's actually a little more to it, but I'll cover that in due time).

The `HISTSIZE` variable sets the number of commands to remember in the command history. If not set, it defaults to 500. `HISTFILESIZE`, when set, will tell bash to truncate the history file, if necessary, by removing the oldest entries, to contain no more than that number of lines. Again, the default value is 500. The history file is also truncated to this size after writing it when an interactive shell exits.

`HISTCONTROL` is a very useful variable. Assign `HISTCONTROL` a colon separated list of the following options to alter how history is saved:

- `ignorespace`: lines which begin with a space character are not saved in the history list.

- `ignoredups`: lines matching the previous history entry are not saved.

- `ignoreboth`: enforces both `ignorespace` and `ignoredups`.

- `erasedups`: causes all previous lines matching the current line to be removed from the history list before that line is saved. If `HISTCONTROL` is not set, all lines read by the shell parser are saved in the history list. If you like to watch a directory by executing "`ls -l`" and then repeatedly pressing up-arrow-return, `ignoredups` is for you! This way, you'll only see one "`ls -l`" in history no matter how many times you repeat the command.

`HISTTIMEFORMAT` is a variable I see get very little use, but I find immensely useful. Simply, when set, each entry in the history list will have a timestamp save with the entry. With the example setting I give above, my history looks like this:

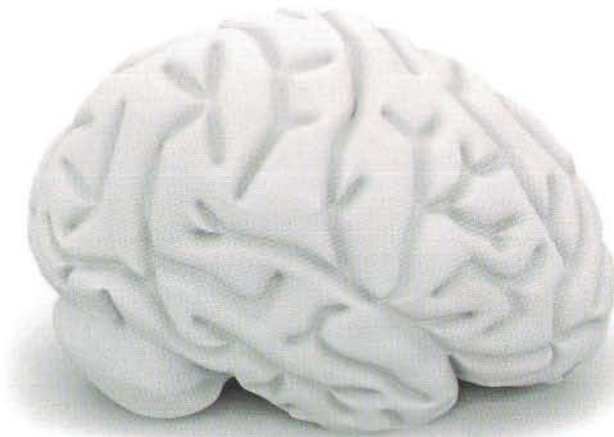
```
580 Jul 29 08:25:26: cd dev/objc/
581 Jul 29 08:25:27: ls -la
582 Jul 29 08:34:29: cd dumb
```

Yes, I have a directory named "dumb." I also have several shell options defined, but the most important relating to history is this:

```
shopt -s histappend
```

The `histappend` option appends the history from the current shell when it exits to the history file. This is useful – I'd claim critical – when using multiple shells. To explain further, shell history is not immediately written to the history file, but is

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maintained per shell, and written on shell exit. If I have two shells running, the last to exit writes the history file that it maintained. If you only even use a single shell at a time, you wouldn't notice this behavior, but I think it's a nice option to have enabled regardless.

As an aside: I actually use two other shell options: `histverify` and `histreedit`. Both affect substitution and shell expansion. Both are also a little outside the scope of this article, however, the `bash` man page has more information if you're so inclined.

Another aside: I really like setting the `cmdhist` option, too using:

```
set cmdhist
```

This option will save multi-line entries as a single line in history. Multi-line entries are created using the backslash character at the end of a line. For example, with `cmdhist` set, if I were to enter the following:

```
$ for i in `ls`; do \  
> echo $i; \  
> done
```

...my history would actually contain:

```
for i in `ls`; do echo $i; done
```

It's all up to personal taste if you prefer this or not, so, use what works best for you.

More History

Just investigating `bash` history functionality alone is a deep topic. Mainly because it exists to *save you work*, always remember that. So, now you can up-and-down-arrow through history, and use the `history` command to list all history. If you typed a command that you want to recall, you can certainly press up-arrow until you find it. What if that command is way back? Well, you could remember part of the command and use `grep` to find it:

```
$ history | grep ssh  
272 Jul 25 10:09:56: ssh 192.168.76.84  
285 Jul 25 14:39:53: ssh marczak@192.168.76.84  
287 Jul 26 09:06:04: ssh 192.168.125.164  
289 Jul 26 11:10:58: ssh marczak@192.168.76.84  
295 Jul 26 16:27:13: man ssh  
296 Jul 26 23:10:19: ssh mm@db.wheresspot.com  
298 Jul 27 09:19:18: ssh mm@db.wheresspot.com  
330 Jul 27 09:52:21: ssh minoc  
331 Jul 27 09:17:26: ssh serveradmin@ballast
```

(remember – I'm showing an option timestamp, which you likely won't see). From this list, you could copy and paste the line you'd like to repeat (yuck). Or, you can ask `bash` to expand by the history id. This is called history expansion. For example,

if I wanted to repeat the “`ssh marczak@192.168.76.84`” line – history id 285 – I can type this:

```
!285
```

and press return. Much easier than retyping the entire line. While using `grep` to find things in history is OK for a grand overview, there are other, more refined ways of recalling history.

To broaden the scope of the exclamation point operator, in general, after the exclamation point you specify an *event designator*. A number will recall a specific numbered event in history. Here's a handy list of useful designators:

(numerical value)	–	recall specific event in history
!	–	previous line
(text)	–	previous line starting with given text.
(?text)	–	previous line containing text

Examples are always best, so, here's one of each (save “numerical value,” which you've already seen in action).

If you `ssh` into a remote machine, do your work, get out and then realize, “oops – I need to do one more thing,” simply type `!!` and press return. This will run the previous command. Remember: this is a substitution, so, you can use “`!!`” wherever you want to substitute the previous command. An example of this would be:

```
$ ps ax | grep [W]ord | awk '{print $1}'  
28976  
$ kill $(!!)
```

The text designator substitutes the previous match. For example, if I wanted re-run the `ps` command from the previous example – you know, to make sure it's *really* dead – typing `!ps` and pressing return will match that `ps`, and execute the entire line.

The final designator that I'm going to show matches text anywhere in the event, not just the beginning. To once again rely on the previous example, to now match the `ps` event, you could type `!?ord`, or even `!?awk`, press return and re-execute the entire `ps` expression.

Readline

Developed by GNU, `bash` uses the `readline` library for its command input. Simply stated, `readline` provides a set of functions that allow users to edit command lines as they are typed in. `Readline` is also responsible for providing the history function to `bash` (and other applications that choose to include it). `Readline` is a bit of a discussion in and of itself, so, I'm just going to show one immediately available function, and one tweak that makes all the difference to my history experience.

`Readline` runs in one of two modes: `emacs` or `vi`. The default is `emacs` mode. This allows you to use `emacs` key bindings to move about the command line. It's actually the

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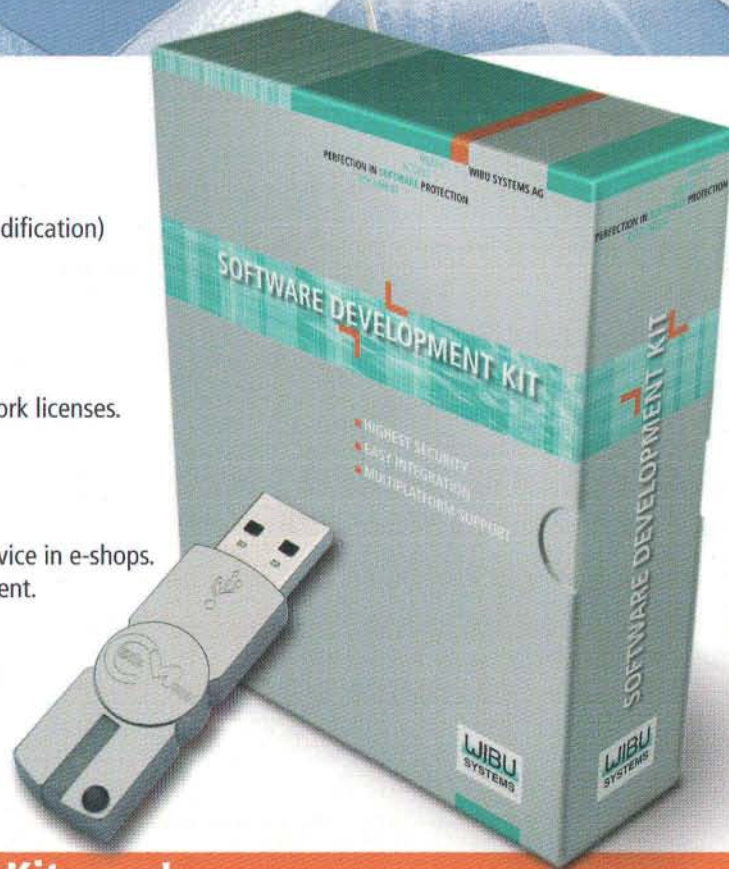
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source of the keyboard commands shown last month. From this, we gain reverse search through our history. Press ctrl-r, and your prompt will change to "(reverse-i-search)`:", alerting you that what you type is a search back through history. Each key press finds the best previous match. If what you type fails to match an event in history, you receive a bell (visual or audible, depending on how your session is configured). If you have more than one match, press ctrl-r again to cycle through matches.

Readline is configured using the file .inputrc that it finds in your home directory (you'll need to create this file, as it's not there by default). This allows for further customization and ways to implement features that match the way you work. Here's the .inputrc file that I use:

```
"\e[B": history-search-forward  
"\e[A": history-search-backward
```

```
Space: magic-space
```

The first two lines bind the up and down arrow to searching forward and back through history. You may think the arrows already so this – and they do to a degree – however, with this addition, a little typing goes a long way. With these lines in your ~/.inputrc, if you were to type ssh, and *then* press the up arrow, you'll navigate back through history only seeing events that match the beginning "ssh". The "magic-space" line causes readline perform expansion each time the space bar is pressed.

One final note: bash isn't the only application that uses readline. This means that changes to .inputrc will affect *all* applications relying on it. For example, the command-line MySQL client uses the readline library to implement command-line editing and history retrieval. If you want a particular setting to apply only to one environment, .inputrc does understand a limited form of conditionals. So, to cause settings to only apply to bash, use this in .inputrc:

```
$if bash  
Space: magic-space  
$endif
```

This conditional will cause the magic-space behavior to apply only to bash. Naturally, any settings can be placed in the conditional.

CDPATH

CDPATH is simply a shell variable. Like the PATH variable, which tells the shell which paths to search for an executable, CDPATH informs the cd command which paths to look in when changing directories. This is a simple way to reduce your typing. CDPATH is specified just like PATH: a list of directories, separated by a colon. If, for example, to search your home directory and /Users/Shared, specify this:

```
CDPATH=".:~/Users/Shared"
```


The "dot" up front in that specification tells `cd` to search the current directory. You probably want to do that, right? Using the `CDPATH` shown, if there's a directory named "photo" under `/Users/Shared`, and my present working directory (`pwd`) is `~/Library` (or anywhere, really), simply typing `cd photo` will change my present working directory to `/Users/Shared/photo`.

This should tie into good usage of the `PS1` variable as described in the previous column, as you should always have a visual clue as to which directory you actually currently in.

The order of `CDPATH` is important. Just like the `PATH` variable, first match "wins." Using the previous example, if there was a directory named "photo" in both my home directory *and* `/Users/Shared/`, typing `cd photo` would bring me to the photo directory in my home. Thanks to the current directory specification (".") up front, the current directory always takes precedence, so, you'll always have 'normal' behavior.

Bash Programmable Completion

Modern versions of bash allow programmable completion, extending the standard completion that the Tab key normally provides. Again, this is a topic that can probably take up its own article or chapter in a book. Investigating every aspect of programmable bash completion is beyond the scope of this article, but I need to point out that it exists, and how to get some useful completions running in your shell.

Here's what the bash man page says about standard completion (pressing the Tab key):

"Attempt to perform completion on the text before point. Bash attempts completion treating the text as a variable (if the text begins with `$`), username (if the text begins with `~`), hostname (if the text begins with `@`), or command (including aliases and functions) in turn. If none of these produces a match, filename completion is attempted."

However, this basic setup can be improved. For example, on an unadorned bash-shell-out-of-the-box on OS X, if you were to type `man dsed` and press Tab, you'll just receive a bell. Wouldn't it be nice if you could press tab and have the line completed with `man dseditgroup`? Here's what the bash man page says about programmable completion:

"When word completion is attempted for an argument to a command for which a completion specification (a `compspec`) has been defined using the `complete` builtin, the programmable completion facilities are invoked.

First, the command name is identified. If a `compspec` has been defined for that command, the `compspec` is used to generate the list of possible completions for the word. If the command word is a full pathname, a `compspec` for the full pathname is searched for first. If no `compspec` is found for the full pathname, an attempt is made to find a `compspec` for the portion following the final slash.



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Once a compspec has been found, it is used to generate the list of matching words. If a compspec is not found, the default bash completion as described above under Completing is performed."

A bit wordy, perhaps. However, the upshot is this: you can have bash complete on just about anything. If your company has custom command-line utilities, you could create a completion specification for the valid switches and completions for your specific utility! The key to it all is the `complete` built-in command.

Last month, we touched on aliases and functions. As a quick refresher, a function is a subroutine, or, a code block that implements a set of operations. This function will add two numbers together and print their result:

```
#!/bin/bash

function sum() {
    total=$(( $1+$2 ))
    echo "The sum of $1 and $2 is $total"
}

sum 5 12
```

As you can see, calling a function is just like executing any bash script: arguments are passed in order into the function. Programmable completion takes advantage of this, allowing you to specify functions that will determine completions for matching text.

As a short example, imagine that we want completions for the `dscl` command. In the interest of space and clarity, our function will only complete on these options: `-read`, `-readall`, `-readpl`, `-readpli` and `-list`. A function that can do this for us would look something like this:

```
_dscl()
{
    local cur prev opts
    COMPREPLY=()
    cur="${COMP_WORDS[COMP_CWORD]}"
    prev="${COMP_WORDS[COMP_CWORD-1]}"
    opts="-read -readall -readpl -readpli -list"

    if [[ $cur == -* ]] ; then
        COMPREPLY=( $(compgen -W "$opts" -- $cur) )
        return 0
    fi
}

complete -F _dscl dscl
```

If you're anxious to try this now, save this in a file named `"dscl"` and source it by typing `source dscl`. Type `dscl -r` at the command prompt and press the Tab key. bash should complete the `"-r"` as `"-read"` for you. Press the Tab key twice, and you'll see that it'll match the other `"-read"` entries we supplied. Very cool. How does it work?

We start out by defining some variables: `cur`, the current match (being typed at the command-line), `prev`, the previous word typed and `opts`, which is the list of options to complete. The actual completion is handled by the `compgen` bash built-in. `compgen` is used to fill in the `COMPREPLY` variable.

`COMPREPLY` has special meaning to bash in that it holds the output of a completion.

You can certainly use this function as a template. However, while it works for simple completions, a function could certainly be much more powerful and complex. What if you're just trying to get your completion fix and don't have the time/skills/energy to write an in-depth function for completion?

Fortunately, there are many good bash completion examples full scripts that you can download. One of the best is created by Ian Macdonald, and is available from <http://www.caliban.org/files/bash/bash-completion-20060301.tar.gz>. While originally created with Linux in mind, this comprehensive completion file is ideal for OS X, too. Even better: any Linux-specific commands that it can't find on OS X are simply not loaded, saving memory.

To use it, download the file, unarchive it, and find the `bash_completion` file at the top level of the resulting directory. Copy that into `/etc`. Have your bash initialization script source it:

```
. /etc/bash_completion
```

(`."` is a synonym for the `source` command). If you don't want to wait to login to a new shell, source it right at the command line. You can test it with one of the completions it brings: the `cd` completion. Wait...doesn't `cd` already complete with the built-in completion? Well, yes, but it's free to do so in meaningless ways. If you have a file in your home directory named `"current-list"`, and a directory named `"current_projects"`, the unmodified completion will complete the word `"current"`, but then wait for you to clarify. With the programmed behavior, we realize that with the `cd` command, only one of the choices makes sense – the directory. Now you should notice that typing `cd cur` followed by the Tab key, you'll get the correct, full completion.

This bash completion file provides a framework for creating completions. If you want to finish off the `dscl` example above, or, create one for a custom binary or script, create an `/etc/bash_completion.d` directory, and drop your completion file in there. The `/etc/bash_completion` script is designed to look in `/etc/bash_completion.d` and source each file it contains.

One last tip that, although it gets put into `~/inputrc`, it ties in with tab completion: A helpful completion trick is to drop the following line into your `.inputrc` file:

```
set show-all-if-ambiguous on
```

This addition causes readline to show alternate matches immediately, rather than make you press Tab twice.

Wrapping Up

I hope the tips from this and last month have had an impact on your work inside the bash shell. Many times, it's the little things like this that can make a huge difference in your daily work. I certainly remember the first time I saw these in action after using bash for some time. It was a bit of magic! Quite honestly, while we've covered a lot in this and the previous article, there's even

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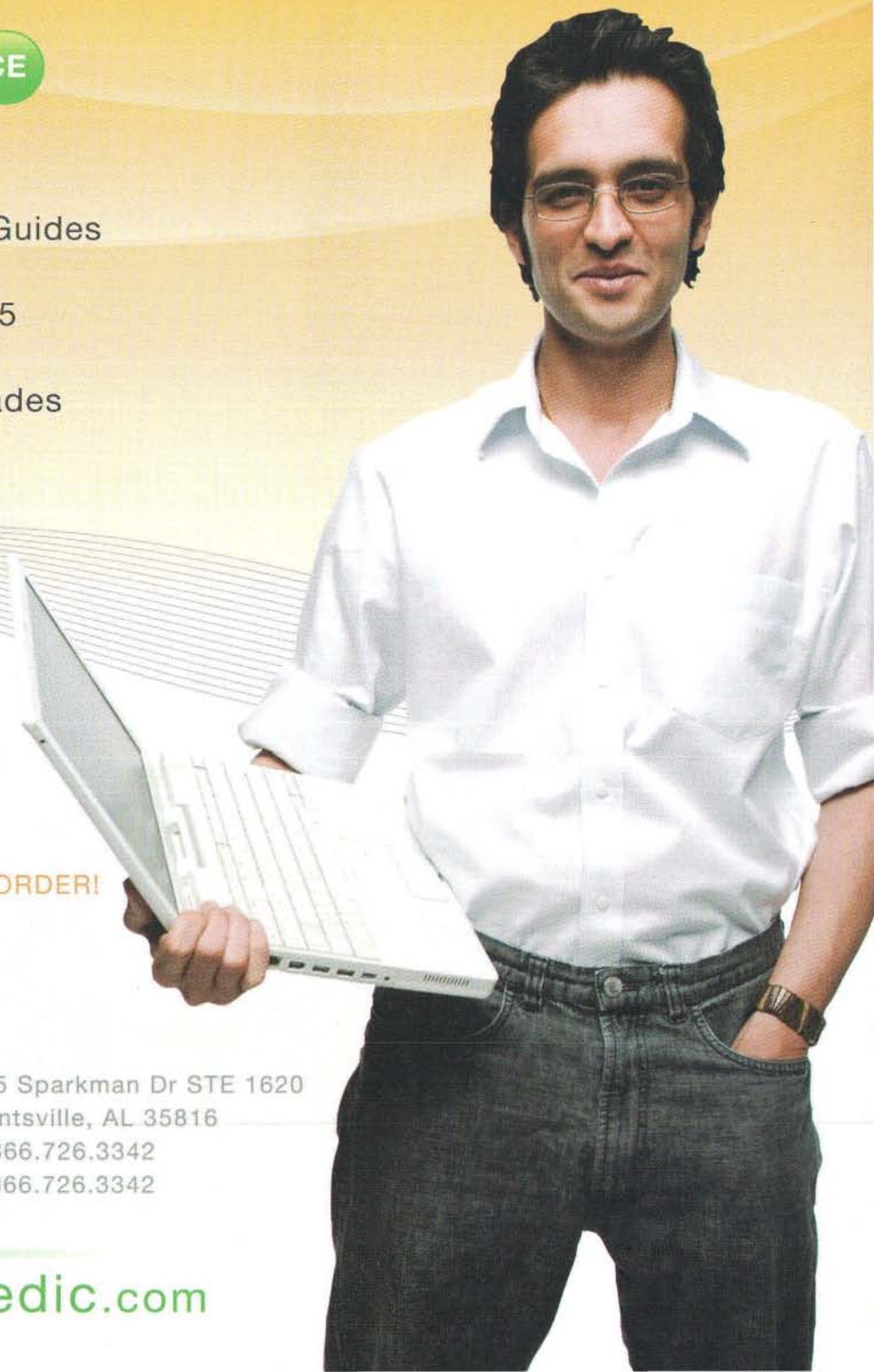
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more to explore in bash. If this coverage has piqued your interest, investigate the `shopt` and `bind` commands along with the many more options available to the readline library.

Media of the month: *Gödel, Escher, Bach: An Eternal Golden Braid*, by Douglas R. Hofstadter. I recently unearthed my copy of this venerable tome and remembered what a revelation it is. Granted, it's not for everyone, but, if you've always wondered about it, or (especially) if you've never heard of it, go find a copy and dig it.

This will most likely be the last bash-specific Mac in the Shell column for some time. If there are any bash topics that you'd like to see explored deeper (or initially), let me know, and we can dig back in. Next month, we'll get into the wider world of scripting in OS X.

Mac



About The Author

Ed Marczak is the Executive Editor for MacTech Magazine, and has been lucky enough to have ridden the computing and technology wave from early on. From teletype computing to MVS to Netware to modern OS X, his interest was piqued. He has also been fortunate enough to come into contact with some of the best minds in the business. Ed spends his non-compute time with his wife and two daughters.

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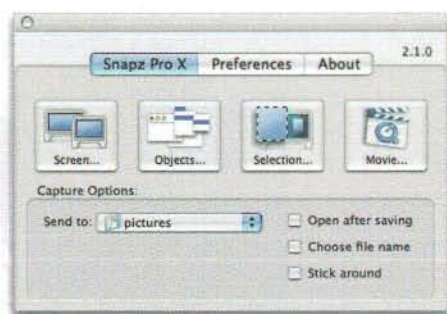
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THE ROAD TO CODE

by Dave Dribin

Come Together, Right Now

Combining bindings, document-based applications, and table views

Putting a Few Things Together

This month in *The Road to Code*, we're going to put together a few concepts we've been working on over the past few months. To start with, we're going to build upon the document-based application we wrote that allowed the user to save and open a document representing a rectangle. We already added archiving and unarchiving support to our `Rectangle` class by implementing the `NSCoding` protocol, briefly discussed using an `NSTableView` to show a list of rectangles, and learned the basics of Cocoa bindings. Now, we are going to combine these three topics to make a document-based application that allows the user to save a list of rectangles and to add and remove rectangles, both with and without Cocoa bindings.

Documents with a Table View

First, let's make sure we're all using the same version of Xcode. Version 3.1 was released in July and is now the current version. I'm going to use it going forward. Now that we're all using the same version of Xcode, let's create a new document-based application called **Rectangles**. This project template creates a `NSDocument` subclass, `MyDocument`, for you to customize. But before we start coding, let's layout the user interface in Interface Builder and work our way back.

Open up the `MyDocument.xib` file. Interface Builder 3.0 introduced the `.xib` file format and as of Xcode 3.1, the default file format for Interface Builder files in Apple supplied project templates is `.xib` instead of `.nib`. While the file format and extension has changed, they are identical from the developer's perspective: they contain the GUI you develop in Interface Builder. Create a

window with a table view that looks similar to Figure 1. Be sure that the area and perimeter labels are two separate text fields, one for the text, e.g. one for "Total Area:" and one for the number, as we need to update the number but leave the text as-is. Set up the autosizing so that the table view expands when the window is resized and use a number formatter for each row's text cell and the two area and perimeter number text fields.

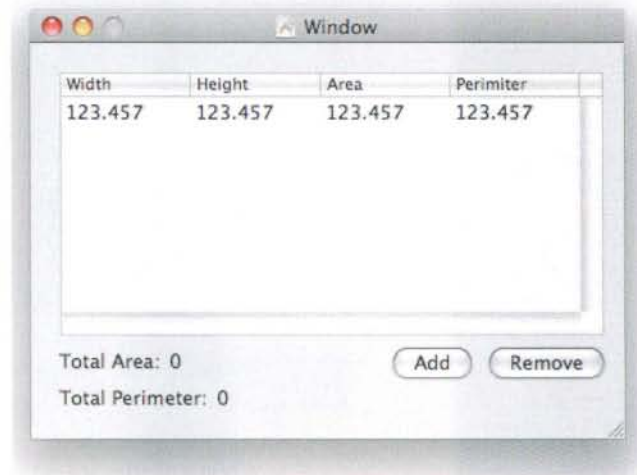


Figure 1: Window in Interface Builder

The table view needs a bit more customization. First, turn off column selection, as we do not want the user to select individual columns. Next, customize each column's identifier and disable editing of the area and perimeter columns. The correct settings are summarized in Table 1. It is important to use all lower-case for the identifier.

Table 1: Table Column Customizations

Column Title	Identifier	Editable
Width	width	Yes
Height	height	Yes
Area	area	No
Perimeter	perimeter	No

With our user interface created, switch back to Xcode. Be sure to enable garbage collection in the build settings for the **Rectangles** target before continuing. All the code we are writing requires garbage collection, and it is not the default setting.

Add in the `Rectangle` class with `NSCoding` support that we created in the July 2008 issue, *One for the Archives*, which you can download from the MacTech website. In our `MyDocument` class, we first need to create outlets for the table view, the **Total Area** and **Total Perimeter** labels, and actions for the **Add** and **Remove** buttons. We also want to create a mutable array instance variable that will hold all rectangle instances. The resultant header file for `MyDocument` is shown in Listing 1.

Listing 1: MyDocument.h

```
#import <Cocoa/Cocoa.h>
```

```
@interface MyDocument : NSDocument
{
    IBOutlet NSTableView * _tableView;
    IBOutlet NSTextField * _totalAreaLabel;
    IBOutlet NSTextField * _totalPerimeterLabel;

    NSMutableArray * _rectangles;
}

- (IBAction)addRectangle:(id)sender;
- (IBAction)removeRectangle:(id)sender;

@end
```

Switch to the implementation file, `MyDocument.m`. Modify the constructor to create the `_rectangles` array as follows:

```
- (id)init
{
    self = [super init];
    if (self == nil)
        return nil;

    _rectangles = [[NSMutableArray alloc] init];

    return self;
}
```

Also add these three methods for the actions:

```
- (void)updateTotalAreaAndPerimeter
{
    float totalArea = 0;
    float totalPerimeter = 0;
    for (Rectangle * rectangle in _rectangles)
    {
        totalArea += rectangle.area;
        totalPerimeter += rectangle.perimeter;
    }

    [_totalAreaLabel setFloatValue:totalArea];
    [_totalPerimeterLabel setFloatValue:totalPerimeter];
}

- (IBAction)addRectangle:(id)sender
{
    Rectangle * rectangle = [[Rectangle alloc] initWithLeftX:0
    bottomY:0
    rightX:15
    topY:10];
    [_rectangles addObject:rectangle];

    // Update the UI
    [_tableView reloadData];
    [self updateTotalAreaAndPerimeter];
}

- (IBAction)removeRectangle:(id)sender
{
    NSInteger selectedIndex = [_tableView selectedRow];
    // If no row is selected, don't do anything
    if (selectedIndex == -1)
        return;

    [_rectangles removeObjectAtIndex:selectedIndex];

    // Update the UI
```

```
[_tableView reloadData];
[self updateTotalAreaAndPerimeter];
}
```

Taking a closer look at these three methods, the `addRectangle:` method creates a new 15x10 rectangle and adds it to the array of rectangles. It then has to update the user interface so that it matches the array. The `reloadData` method of `NSTableView` causes the table view to refresh its contents from its data source. We also need to update the area and perimeter labels. We created the `updateTotalAreaAndPerimeter` method to calculate the total area and perimeter and update the labels.

The `removeRectangle:` action removes the currently selected rectangle. It asks the table view for the selected row index and uses this to remove the correct rectangle. Again, it updates the user interface to match the array.

That's all for coding, at the moment. Save your modifications and build the project, making sure to fix any syntax errors. Now, switch to Interface Builder because we need to connect our outlets and actions. Connect the outlets to their corresponding components, and connect the buttons to the two actions methods.

At this point, our application will run, and the buttons will work, but the table view will not be correctly populated with data. We need to use the table view's data source to populate the data. While we're in Interface Builder, set `MyDocument` to be the data source by connecting the `NSTableView`'s `dataSource` outlet to **File's Owner**, which represents `MyDocument`. Switch back to Xcode and add these three required data source methods:

```
#pragma mark -
#pragma mark Table view data source

- (int)numberOfRowsInTableView:(NSTableView *)aTableView
{
    return [_rectangles count];
}

- (id)tableView:(NSTableView *)tableView
objectValueForTableColumn:(NSTableColumn *)tableColumn
row:(NSInteger)rowIndex
{
    Rectangle * rectangle = [_rectangles
    objectAtIndex:index:rowIndex];
    NSString * identifier = [tableColumn identifier];

    float value = 0;
    if ([identifier isEqualToString:@"width"])
        value = rectangle.width;
    else if ([identifier isEqualToString:@"height"])
        value = rectangle.height;
    else if ([identifier isEqualToString:@"area"])
        value = rectangle.area;
    else if ([identifier isEqualToString:@"perimeter"])
        value = rectangle.perimeter;

    return [NSNumber numberWithFloat: value];
}

- (void)tableView:(NSTableView *)tableView
setObjectValue:(id)object
forTableColumn:(NSTableColumn *)tableColumn
row:(int)rowIndex
{
    Rectangle * rectangle = [_rectangles
    objectAtIndex:index:rowIndex];
    NSString * identifier = [tableColumn identifier];
```



```
float value = [object floatValue];
if ([identifier isEqualToString:@"width"])
    rectangle.width = value;
else if ([identifier isEqualToString:@"height"])
    rectangle.height = value;

// Update the UI
[self updateTotalAreaAndPerimeter];
}
```

We are using the column identifier to get or set the correct value from the `Rectangle` instance. Because the `NSTableView` data source deals only with objects, we need to convert the float values to and from `NSNumber`s. Now our application should run, and you should be able to add rectangles, modify their width or height, and remove rows. Figure 2 shows an example screen shot.

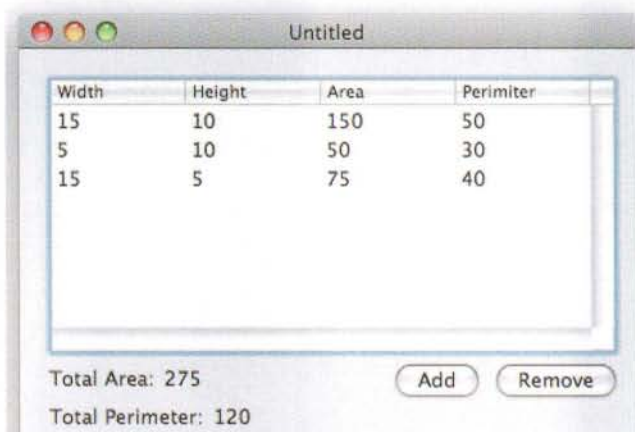


Figure 2: Screen Shot

The final detail missing from our application is the ability to save and open a custom document type. As we did in *One for the Archives*, we need to override two methods in our `NSDocument` subclass:

```
- (NSData *)dataOfType:(NSString *)typeName
    error:(NSError **)outError
{
    NSData * rectangleData =
        [NSKeyedArchiver
        archivedDataWithRootObject:_rectangles];
    return rectangleData;
}

- (BOOL)readFromData:(NSData *)data
    ofType:(NSString *)typeName
    error:(NSError **)outError
{
    _rectangles = [NSKeyedUnarchiver
    unarchiveObjectWithData:data];
    return YES;
}
```

These method implementations are very easy because both `NSMutableArray` and `Rectangle` support archiving via `NSCoding`. An array just archives each object in turn. We also have to set up the document types for our application. Open the **Info** panel on the **Rectangles** target and add a "rectangles" extension to the first document type as shown in Figure 3.

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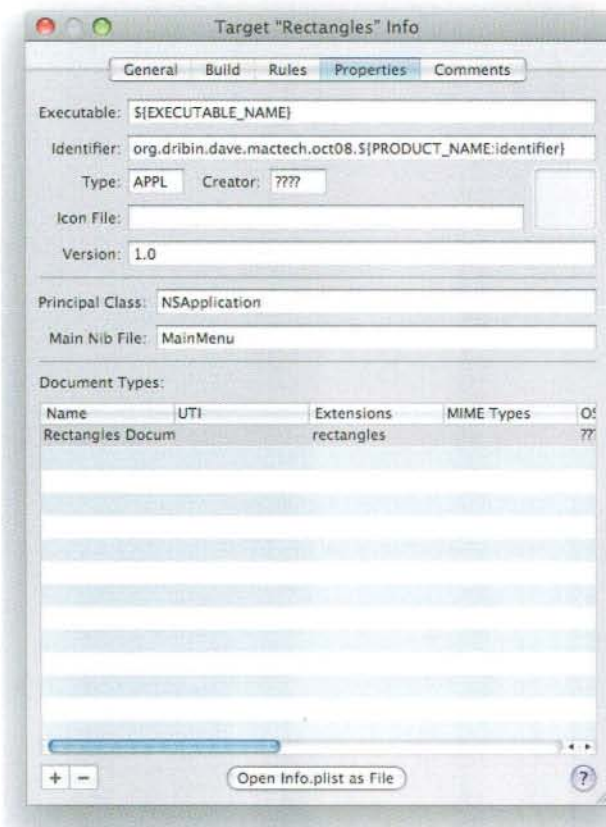


Figure 3: Rectangles target info

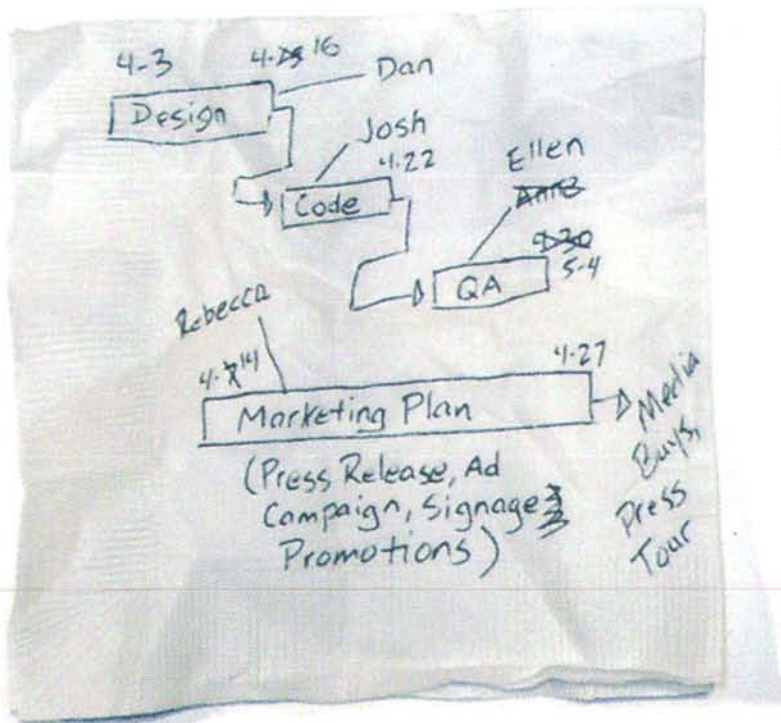
We now have a document-based application that can save and open an array of rectangles. This is not much different than the document-based application we wrote a few months ago, but it does show how to use a mutable array as the data source for a table view. We are going to be making some modifications to this application, culminating in the creation of a Cocoa bindings version.

Utilizing Key-Value Coding

The first step is to modify the data source accessor methods to be a little more flexible. Currently, they are big if statements based on the column identifier. Adding or changing columns requires changing these data source methods to match the changes we make in Interface Builder.

The simplest way to do this is to use key-value coding (KVC) to get and set the rectangle's properties in the data source. While identifiers are generally arbitrary, we are going to give them special meaning. For this to work, we are going to use key names as the column identifiers. Assuming you used the identifiers I recommended in Table 1, you are all set to go. Modify the data source methods as follows:

```
- (id)tableView:(NSTableView *)tableView
objectValueForTableColumn:(NSTableColumn *)tableColumn
row:(NSInteger)rowIndex
{
    Rectangle * rectangle = [_rectangles
objectAtIndex:rowIndex];
    NSString * identifier = [tableColumn identifier];
    return [rectangle valueForKey:identifier];
}
```



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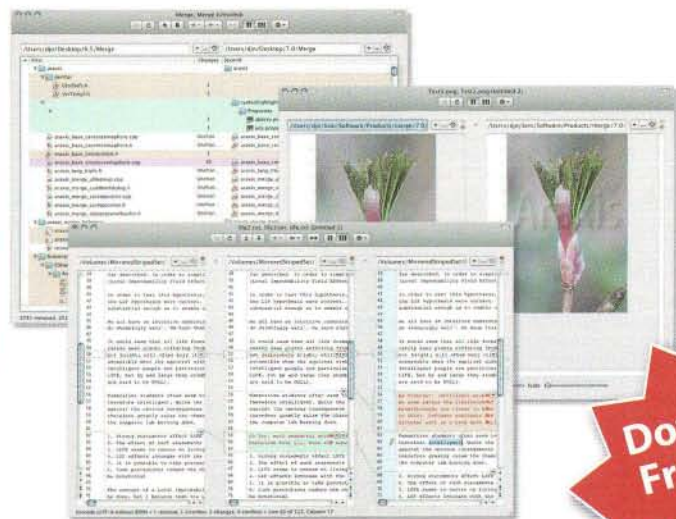
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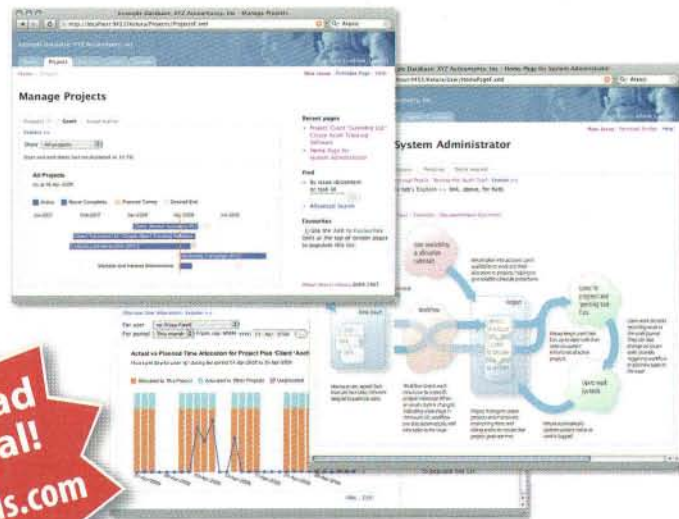
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```

- (void)tableView:(NSTableView *)tableView
  setObjectValue:(id)object
  forTableColumn:(NSTableColumn *)tableColumn
  row:(int)rowIndex
{
    Rectangle * rectangle = [_rectangles
objectAtIndex:rowIndex];
    NSString * identifier = [tableColumn identifier];
    [rectangle setValue:object forKey:identifier];

    // Update the UI
    [self updateTotalAreaAndPerimeter];
}

```

In `objectForTableColumn:`, we use `valueForKey:` to retrieve the appropriate property. If our identifiers did not match their corresponding property names, we would get a runtime error. Notice that we do not have to convert the float values into `NSNumber` objects either, as KVC automatically does this for us. The `setObjectValue:` method conversely uses `setValue:forKey:` to set the appropriate property given the object value.

Switching to Cocoa Bindings

Using KVC in the data source is the first step towards using Cocoa bindings. Looking at the data source code now, it's barely specific to our application. We could take this code wholesale on a new project and use it almost without modification. The trick is to use KVC key names as the table column identifiers. Cocoa bindings takes this to the next logical step and provides reusable controllers based on KVC to eliminate repetitious controller code.

Last month, we used `NSObjectController` as the controller for a single `Rectangle` instance. However, now we have an array of `Rectangles` we want need to manage, and `NSObjectController` will no longer work. Thankfully, the `NSArrayController` is just what we need. This is a reusable controller for managing an ordered list of objects.

To use an array controller, find it in Interface Builder's **Library** window, and drag it over to the `MyDocument.xib` window. The array controller's icon in the **Library** panel is shown in Figure 4.

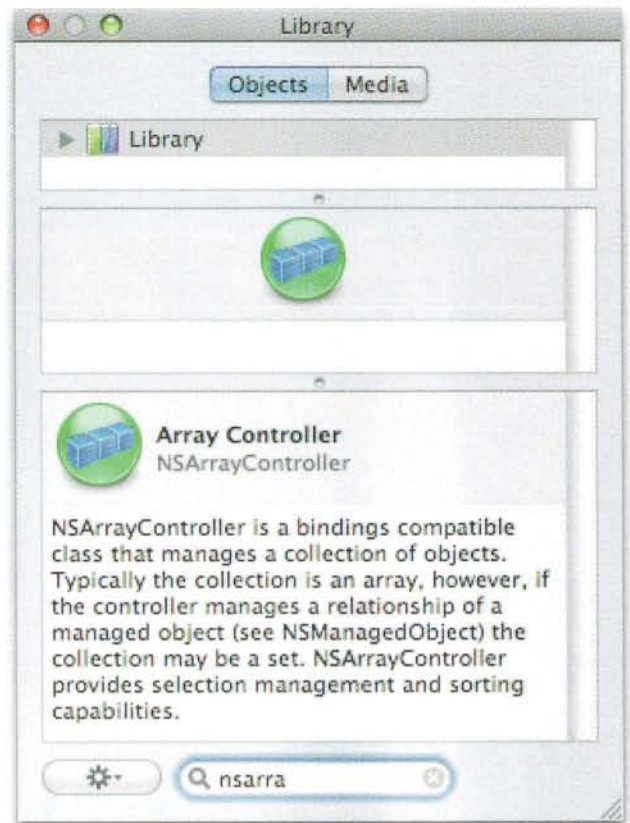


Figure 4: Array Controller in the Library Panel

Rename the array controller to **Rectangles**, as shown in Figure 5. Set the **Class Name** of the controller to **Rectangle** and check the **Prepares Content** option as shown in Figure 6. The class name is important because our array controller can add objects to the array. If it does not use the correct class, our code will no longer work properly.



Figure 5: Array Controller in XIB window

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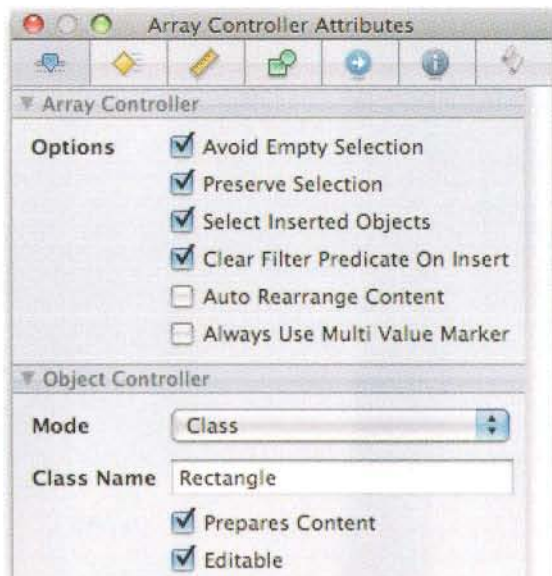


Figure 6: Array Controller Attributes

Now it's time to configure the table columns to use bindings. Let's start with the width column. Bind the column to the `Rectangles` controller with a **Controller Key** of `arrangedObjects` and a **Model Key Path** of `width`, as summarized in Figure 7. The `arrangedObjects` controller key represents each object in the ordered list. When used in a table view, it will use the row index to find the correct object in the ordered list, just as we did in our data source methods. The model key tells this column to use the

width property as the value. It's important to use `arrangedObjects` because an array controller can re-sort the objects in the list without affecting the original array. An example of this is when the user clicks on a table header.



Figure 7: Width column bindings



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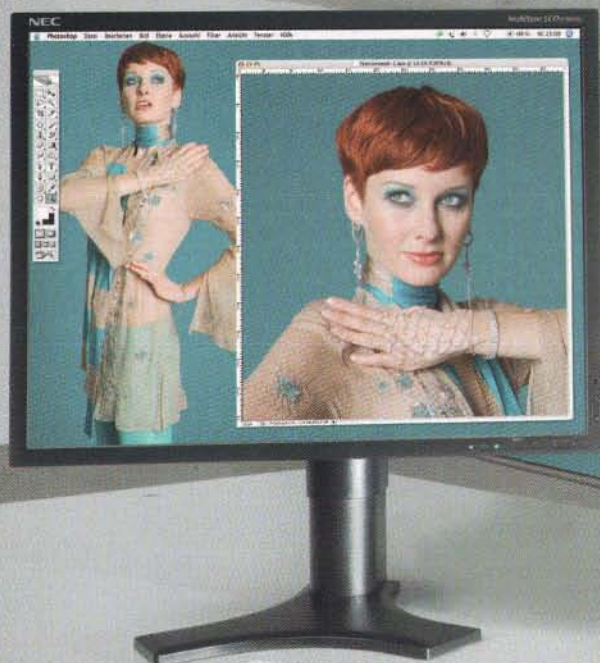


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Repeat the bindings for each of the columns. The controller and **Controller Key** are the same for all columns, but change the **Model Key** to be the appropriate property name. The model key should be the same as the identifier we used earlier, as it gets used with KVC by the array controller.

At this point you can delete the three data source methods from our `MyDocument` class and disconnect the data source outlet of the table view. We are now using bindings to populate the table view rather than using the data source. We also have to modify our add and remove actions to work in a KVC-compliant manner:

```
- (IBAction)addRectangle:(id)sender
{
    Rectangle * rectangle = [[Rectangle alloc]
initWithLeftX:0

    bottomY:0

    rightX:15

    topY:10];
    [[self mutableArrayValueForKey:@"rectangles"]
addObject:rectangle];
}

- (IBAction)removeRectangle:(id)sender
{
    NSInteger selectedIndex = [_tableView selectedRow];
    // If no row is selected, don't do anything
    if (selectedIndex == -1)
        return;

    [[self mutableArrayValueForKey:@"rectangles"]
removeObjectAtIndex:selectedIndex];
}
```

The issue is that we cannot modify the `_rectangles` array directly because the array controller will not notice the updates. The array controller uses key-value observing (KVO) to monitor changes to the model and update the view. When you modify the array directly, you are not doing it in a way that triggers KVO notifications. By using `mutableArrayValueForKey:`, we are given a mutable array proxy to the “rectangles” key that sends proper KVO notifications. This is probably one of the most common issue newbies have with Cocoa bindings. There are other ways to modify the “rectangles” key in a KVO-compliant manner, but using this array proxy is the easiest.

We are not quite finished. Our actions no longer use the `updateTotalAreaAndPerimeter` method, and we can delete it, but we still need some way to update the total area and perimeter labels. We are going to use bindings for these, too. Switching back to Interface Builder, select the total area number text field. Bind it to the **Rectangles** controller and the **arrangedObjects** controller key, just as you did for the table columns; however, for the **Model Key Path**, use the string `@sum.area` as shown in Figure 8.

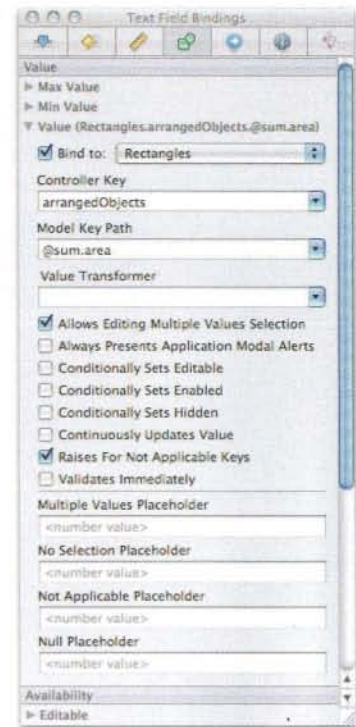


Figure 8: Total Area binding

Since `arrangedObjects` is an array of objects, we cannot directly use it for a text field, which only displays one object. The “@sum” string is known as a *collection operator*. It takes the next key path, in this case “width,” and calculates the total sum of each value. Thus, the binding of “`arrangedObjects.@sum.width`” automatically calculates the total width for us without any code. Similarly the total perimeter text field should be bound to the `@sum.perimeter` model key path.

There are other collection operators, including “@count”, “@min”, and “@max” that calculates the number of items in array, the minimum value, and maximum value respectively. These collection operators allow us to use Cocoa bindings where we previously had to write controller code. In this case, it replaces our `updateTotalAreaAndPerimeter` method, and it does so in a KVO-compliant manner. If any of the rectangles in the array changes, the total will automatically be updated using KVC/KVO. Well, *almost* automatically.

If you copied the `Rectangle` class from the July issue, as I suggested earlier, it will not have the dependent keys defined. Just as we did in last month’s article, we need to add these two methods to the `Rectangle` class:

```
+ (NSSet *)keyPathsForValuesAffectingArea
{
    return [NSSet setWithObjects:@"width", @"height", nil];
}

+ (NSSet *)keyPathsForValuesAffectingPerimeter
{
    return [NSSet setWithObjects:@"width", @"height", nil];
}
```




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This makes the area and perimeter dependent on the width and height. Thus, when the user edits the width of one of the rectangles in the table, it causes KVO notifications to be sent for the width and then the area and perimeter. These area and perimeter KVO notifications then trigger the total area and perimeter labels to be recalculated.

But wait...there's more!

Cocoa-bindings has allowed use to get rid of the table view data source and other GUI updating code. But we can also get rid of our action methods. The array controller has add and remove action methods we can use. Switching back to Interface Builder, control drag from the **Add** button to the **Rectangles** array controller and choose **add:** action from the popup. Similarly, connect the **Remove** button to the **remove:** action.

The array controller also allows us to enable and disable the **Add** and **Remove** buttons properly. For example, when there is no selected row, the **Remove** button should be disabled. You can do this by binding the **Enabled** property of the buttons. Bind the **Enabled** property of the **Add** button to the **canAdd** controller key, as shown in Figure 9. Also bind the **Enabled** property of the **Remove** button to the **canRemove** controller key.



Figure 9: Add button Enabled binding

If we run our application with these actions and bindings to the array controller, the application still works. The **Remove** button even gets disabled when no row is selected. However, there is one issue. Now our new rectangles are all created with zero width and height. This is because the array controller just calls the **init** method on the new **Rectangle** object. For the **Rectangle** class, the default constructor just sets all instance variables to zero. There are a few ways to remedy this situation:

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modify the Rectangle model class to have different default values in the default constructor,

subclass NSArrayController and override the newObject method, or

use our own custom add action.

I don't generally like modifying the Rectangle class to satisfy the UI as it's putting logic that should be part of the view (the UI) into the model class. What if a different user interface wanted different default values? To me, the default values should be part of the controller layer, not the model. But every case is different, and sometimes putting default values inside the model is fine. Since our application's default of a 15x10 rectangle seems specific to our UI, I don't think the model is the correct place to put it.

This leaves us with subclassing NSArrayController or adding our own custom action method. Neither of these methods is absolutely better than the other, so you could go either way. The downside to the subclassing NSArrayController is that you are creating a new class with just a single method. Keeping the custom action part of the controller may keep related code together in the same class, leading to better code organization. If you want to use the custom action alternative, keep the addRectangle: action method we had previously.

For completeness, I'm going to show you how to subclass NSArrayController, as it is a common technique you are likely come across. Create a new Objective-C class in your project and name it RectanglesController. Modify the header file so that it matches Listing 2.

Listing 2: RectanglesController.h

```
#import <Cocoa/Cocoa.h>
```

```
@interface RectanglesController : NSArrayController
{
}
```

```
@end
```

We don't need to declare any new instance variables or methods, so the interface is pretty sparse. The implementation contains just one method, as shown in Listing 3.

Listing 3: RectanglesController.m

```
#import "RectanglesController.h"
#import "Rectangle.h"
```

```
@implementation RectanglesController
```

```
- (id)newObject
{
    Rectangle * rectangle = [super newObject];
    rectangle.width = 15;
    rectangle.height = 10;
    return rectangle;
}
```

```
@end
```

The newObject method is called whenever the array controller needs to create a new object. We are going to call on the superclass's implementation to create the new rectangle, but

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then we are going to set the width to 15 and height to 10 just as we did earlier. Now we need to use our subclass in Interface Builder. Do this by selecting the **Rectangles** controller from the **MyDocument.xib** window and switching to the **Identity** tab of the Inspector panel. Change the **Class** field from **NSArrayController** to **RectanglesController**, as shown in Figure 10. This tells Interface Builder to create an instance of our array controller subclass instead of the standard Cocoa array controller.

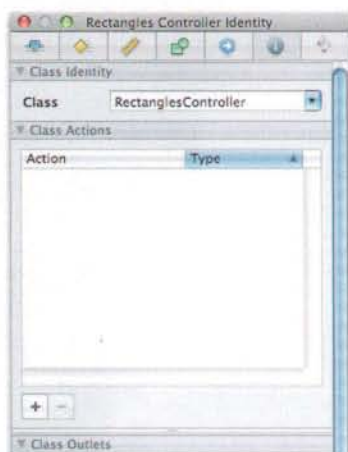


Figure 10: NSArrayController Subclass

Now, when you run the application, the new rectangles should have a default width and height of 15x10. As I mentioned, there's

not a huge advantage to doing this over creating a custom add action method, so do whichever you prefer. The only "trick" to the custom action method is making sure you modify the `_rectangles` array in a KVC-compliant manner as I showed you earlier.

Conclusion

That wraps up another article on *The Road to Code*. We've taken what we've learned over the last few months and created a full-featured document-based application with a table view and Cocoa bindings. You should be proud! We've come a long way since the beginning, and you can accomplish quite a bit with what you have learned.

MI

About The Author



Dave Dribin has been writing professional software for over eleven years. After five years programming embedded C in the telecom industry and a brief stint riding the Internet bubble, he decided to venture out on his own. Since 2001, he has been providing independent consulting services, and in 2006, he founded Bit Maki, Inc. Find out

more at <http://www.bitmaki.com/> *and* <http://www.dribin.org/dave/>.

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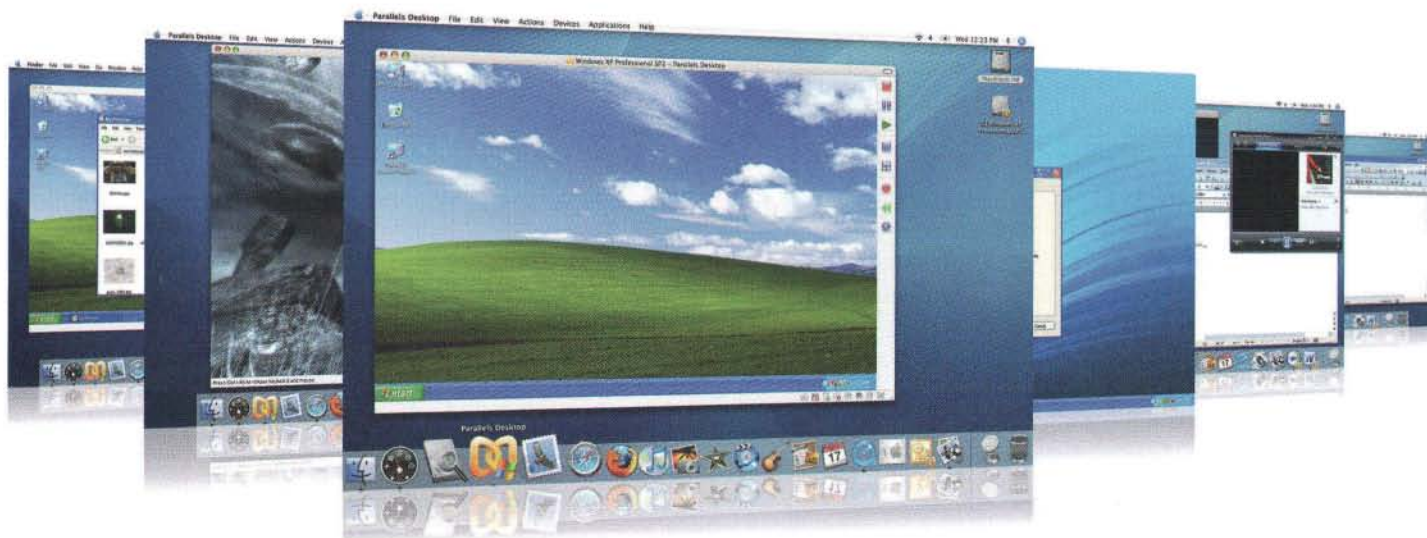
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Migrating FileVault

Moving FileVault-encrypted accounts to a new machine

By Greg Neagle, *MacEnterprise.org*



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Mac OS X enterprise deployment project

Another FileVault challenge

A few issues ago, we looked at implementing FileVault in an enterprise environment. FileVault is Apple's technology for securing the contents of a user's home directory. Your organization may wish to protect its users' data on company laptops, in case a laptop is lost or stolen. Using FileVault is one method to accomplish this goal.

In those earlier issues of MacTech, we looked at preparing for FileVault implementation, turning it on for a given user account, and options for managing, automating, and controlling the use of FileVault in your organization. Later, we looked at dealing with some of the day-to-day issues in dealing with FileVault-protected home directories, and methods for recovering from a lost FileVault password.

Moving FileVault Accounts

One thing not covered in the earlier articles is how you might move a FileVault-protected account and home directory from one machine to another. If you are giving a user a new machine, you may need to move his or her existing account and home directory to the new machine. For reasons best known to Apple, the Migration Assistant is of little help in this task – it refuses to migrate a FileVault user unless there are no other users on the target machine. If you have a machine built from a standard image, you may have one or more prebuilt user accounts, like a local administrative account, on the new machine and so the Migration Assistant refuses to move the FileVault-protected user account.

The advice given by the Migration Assistant is to turn off FileVault, move the account, and turn it back on. While this might work, it is problematic for several reasons:

You'll need the user's password, or at least their cooperation, to turn FileVault off. This requires more coordination between you and the user.

You'll need enough available space on the startup disk to make a duplicate of the contents of the user's FileVault-protected home folder. That space may not be available.

Decrypting and re-encrypting the FileVault-protected home directory can take a long time.

If you are using MCX to enforce FileVault, turning it off (and back on) can present a challenge, as the GUI options are disabled.

So it would be better if we could just move the FileVault-protected account as-is. Fortunately, it can be done, and really isn't that difficult – at least if you aren't afraid of the command line.

Basic Concepts

The basic ideas behind moving the FileVault account are simple:

- Recreate the account information on the new machine.
- Move the FileVault sparseimage or sparsebundle to the new machine.
- Edit the account information to point to the FileVault disk image.
- Of course, the devil is in the details. So let's get started!

Recreating the account

If you are using mobile accounts, recreating the account is easy. Just create a new mobile account for the user – either graphically, or via the command line. In Tiger, the relevant command-line tool is `MCXCacher`, located in

```
/System/Library/CoreServices/mcxd.app/Contents/Resources/
```

You call it like so:

```
cd /System/Library/CoreServices/mcxd.app/Contents/Resources  
./MCXCacher -U usershortname
```

which should create a new mobile account for the network user.



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For Leopard, the relevant tool is called `createmobileaccount`. It is located in `/System/Library/CoreServices/ManagedClient.app/Contents/Resources`.

It's called like this:

```
cd /System/Library/CoreServices/ManagedClient.app
cd Contents/Resources
./createmobileaccount -n usershortname
```

If you aren't using mobile accounts, you can manually recreate the account using the Accounts preferences pane, or the `dscl` command-line utility, but be sure the `shortcode`, `uid`, and `GeneratedUID` of the recreated account match the original. The `dscl` utility can be of great help here, allowing you to read the appropriate values from the old account and write them to the new one:

```
oldmac:/ root# dscl . read /Users/localuser uid
dsAttrTypeNative:uid: 4389
```

```
newmac:/ root# dscl . create /Users/localuser uid 4389
```

Another challenge, if you are not using mobile accounts, is copying the stored password from the old account and machine to the new one, but this, too, can be done. The passwords are stored in `/private/var/db/shadow/hash`. For local accounts, the shadow files are named after the `GeneratedUID` of the user account:

```
root# dscl . read /Users/localuser GeneratedUID
GeneratedUID: 1DECD42B-52EB-4B89-B2B2-359F0623EB1F
```

So for "localuser" above, the password is stored in `/private/var/db/shadow/hash/1DECD42B-52EB-4B89-B2B2-359F0623EB1F`. To copy the password hash from the old machine to the new one, you'd just copy that file.

Move the FileVault disk image

The next step is easier. All you need to do is copy the FileVault disk image from the old machine to the new one. But first, let's do some prep work. If you recreated the account on the new machine, you may have a folder in `/Users` that is partially populated. We don't really need the contents of this folder, as we're going to replace it with the FileVault disk image. If your new machine is running Tiger, or you've recreated a purely local user, just remove all the contents:

```
newmac:/ root# rm -rf /Users/localuser/*
```

If your new machine is running Leopard, and you have recreated a mobile account, you should keep the `.account` directory inside the user's home folder. This stores cached account info and is used by the new External Accounts in Leopard.



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```
newmachine:/ root# ls /Users/mobileuser
.CFUserTextEncoding  Movies
.account              Music
Desktop              Pictures
Documents            Public
Downloads            Sites
Library
```

You can remove everything else in the user's folder; just leave .account.

Let's look at the old machine for a second. You might see two relevant directories in /Users:

```
.localuser/
localuser/
```

If you look inside .localuser/, you'll see the sparseimage/sparsebundle. If you look in localuser/, you'll see an .autodiskmounted file. This happens when the FileVault disk image is not unmounted cleanly. The important bit is that you want to find and copy the sparseimage/sparsebundle, even if it's in a different directory than you were expecting.

One strategy to copy the FileVault disk image is to startup the old machine in FireWire target disk mode, connect it to the new machine, and use `sudo cp` or `ditto` to copy the sparseimage/sparsebundle. If you do this, it's probably a good idea to uncheck the "Ignore ownership" box in the Get Info

window for the FireWire-connected volume. If you don't do this, you can manually reassign ownership of the FileVault image after the copy.

```
cp -pvr /Volumes/oldmac/Users/myuser/myuser.sparsebundle \
/Users/myuser/myuser.sparsebundle
```

```
chown -R myuser /Users/myuser/myuser.sparsebundle
```

If you cannot abide the command line, it is possible to do this completely from the Finder, but you'll need to first change the permissions and/or ownership of the various directories so you can read and write. Be sure to change ownership and permissions back when you are done copying.

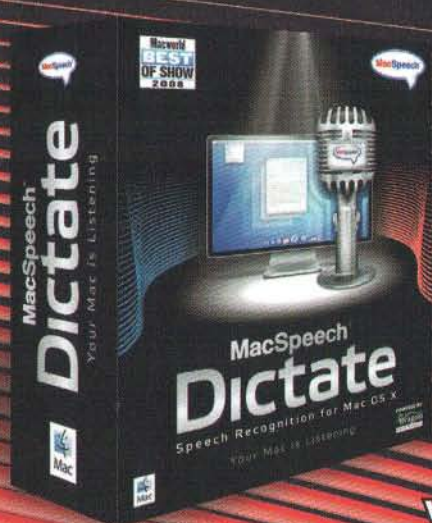
When you are done copying, you should have a username.sparsebundle or username.sparseimage in /Users/username on the new machine. /Users/username and /Users/username/username.sparsebundle should be owned by username, and the owner should have read, write and execute permissions:

```
chown -R username /Users/username
chmod -R u+rwX /Users/username
```

Editing the new account

We're almost there! We've recreated the account, and we've copied the FileVault disk image. But the recreated account has

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the wrong value for the HomeDirectory attribute. We need to fix that. While previous steps could be done without using the command line, I'm afraid that for this task you have no choice but to fire up the terminal.

```
newmac:/ root# dscl . read /Users/myuser HomeDirectory
No such key: HomeDirectory
```

For a "normal" non-FileVault encrypted home directory, this attribute does not exist (the NFSHomeDirectory attribute does exist, but that's a different thing...) We need to create this attribute and point it to the FileVault disk image.

```
dscl . create /Users/myuser HomeDirectory
'<home_dir><url>file:///localhost/Users/myuser/myuser.sparsebu
ndle</url></home_dir>'
```

The above command should be all one line. Substitute the correct username for "myuser" and in "myuser.sparsebundle". If the encrypted home directory is in the older FileVault format, substitute "sparseimage" for "sparsebundle".

If you did everything right, the user should now be able to log in on their new machine with their username and password and access their FileVault-encrypted home directory. And maybe you've learned some things about FileVault, mobile accounts and the Directory Service along the way.

Wrapping up

To review:

We recreated the user account on the new machine, using MCXCacher or createmobileaccount if the account was a

mobile account; or manually if it was a local account, ensuring the shortname, uid, and GeneratedUIDs matched.

For local accounts, we copied the shadow password file. (Recreating a mobile account generates this for us automatically)

We copied the FileVault disk image from the old machine to the new one.

We edited the local accounts' HomeDirectory attribute to point to the FileVault disk image.

That was a lot of work – but should have been faster than turning FileVault off, moving the account and data, and then turning it back on. Additionally, the user's password was not needed to move the account and data. Once you get this technique down, you might consider writing a script to do most of it for you, which is, of course, what I've done. Better would be to help persuade Apple to update the Migration Assistant to do this: if we can do it, so could the Migration Assistant!

MI

About The Author

Greg Neagle is a member of the steering committee of the Mac OS X Enterprise Project (macenterprise.org) and is a senior systems engineer at a large animation studio. Greg has been working with the Mac since 1984, and with OS X since its release. He can be reached at gregneagle@mac.com.

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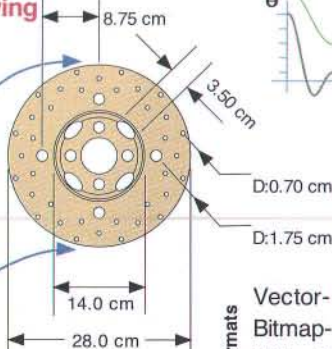
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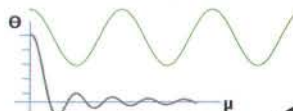
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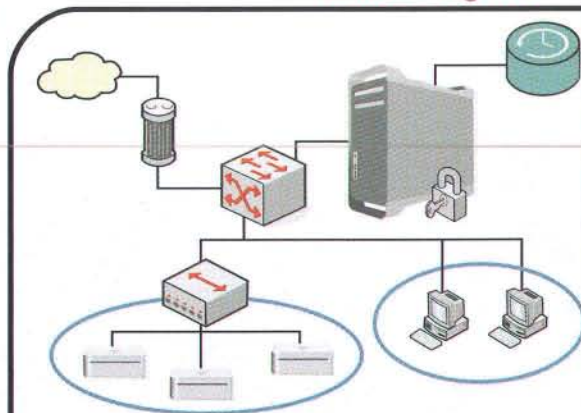
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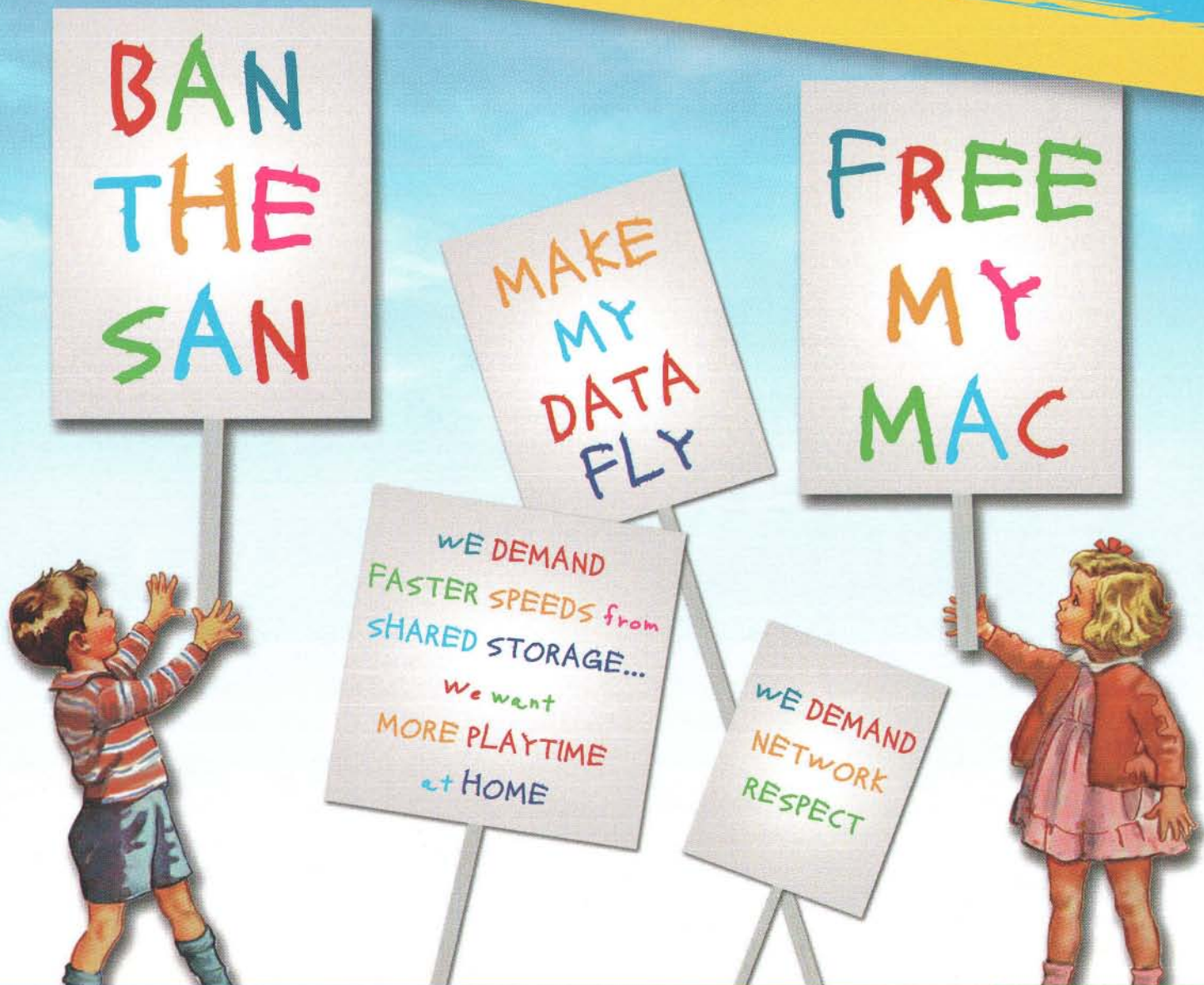
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A Dashboard Widget that Reads and Saves its Preferences

Create a Dashboard Widget that can save and read data after restarting it.

by Mihalis Tsoukalos

Introduction

In this article I am going to illustrate how to create a Dashboard Widget that saves its preferences. After saving the preferences, you will learn how to read and use the saved information and display the selected data in the front side of the Widget. The name of the Widget is "Save Prefs".

The files that compose the Widget

Figure 1 shows the files of the Widget as well as their sizes (in bytes).



Figure 1: The files that compose the "Save Prefs" Widget.

As you can understand by looking at Figure 1, the "Save Prefs" Widget is relatively simple. You should notice that it has a directory –the **AppleClasses** directory– that contains three JavaScript files. Apple provides the contents of the **AppleClasses** directory and the only thing that you should do is to copy the three JavaScript files inside your Widget's directory.

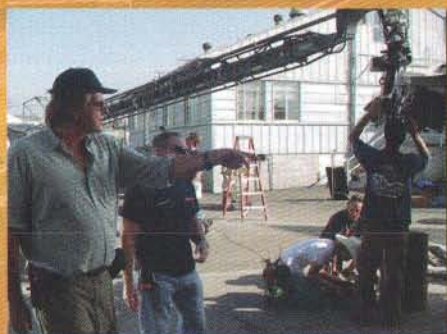
Also, as you will see in the next section, you will have to *include* them in the main HTML file of your Widget. Source code for this project can be downloaded from ftp.mactech.com/src/mactech/volume24_2008/24.10.sit. The source archive contains the following files:

- SavePrefs.html file
- SavePrefs.js file
- SavePrefs.css
- Info.plist

You may think that the `SavePrefs.js` JavaScript file contains a lot of code but most of the code is *typical* when creating a Dashboard Widget. The `showPrefs()` and `hidePrefs()` functions are used for watching and hiding the back side of the Widget and you usually have to copy and paste their definitions to your new Widgets.

The SavePrefs.css file

The CSS file looks pretty simple. Nevertheless, if you make small mistakes to the CSS code the Widget may misbehave very badly! I am saying this because I had some problems with the `#OptionPopup` declaration. Due to my wrong declarations the



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option list was displayed outside of the Widget area and I could not see it at all!

The Info.plist file

The Info.plist file is pretty simple and is as follows:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple Computer//DTD PLIST
1.0//EN"
"http://www.apple.com/DTDs/PropertyList-
1.0.dtd">
<plist version="1.0">
<dict>
  <key>BackwardsCompatibleClassLookup</key>
  <true/>
  <key>CFBundleDisplayName</key>
  <string>Save Prefs</string>
  <key>CFBundleIdentifier</key>
  <string>com.mtsouk.widget.saveprefs</string>
  <key>CFBundleName</key>
  <string>Save Prefs</string>
  <key>CFBundleShortVersionString</key>
  <string>1.0</string>
  <key>CFBundleVersion</key>
  <string>1.0</string>
  <key>CloseBoxInsetX</key>
  <integer>14</integer>
  <key>CloseBoxInsetY</key>
  <integer>16</integer>
  <key>MainHTML</key>
  <string>SavePrefs.html</string>
</dict>
</plist>
```

Explaining the Technique

The presented technique uses the following two JavaScript methods:

- **widget.preferenceForKey(keyName)**: This method tries to read the value of a key, if the value is already saved.
- **widget.setPreferenceForKey(value, keyName)**: This method sets the value of a key. The Dashboard Reference suggests that you should pass *null* in order to delete an existing key.

Apple suggests that you utilize the **widget.preferenceForKey(keyName)** function using the following practice:

```
if(window.widget)
{
  var optionString =
  widget.preferenceForKey("optionString");
  if (optionString && optionString.length > 0)
  {
    optionText.innerHTML = optionString;
  }
}
```

Similarly, Apple suggests that you use the **widget.setPreferenceForKey(value, keyName)** function as follows:

```
if(window.widget)
{
  widget.setPreferenceForKey("Hello
MacTech!","optionString");
}
```

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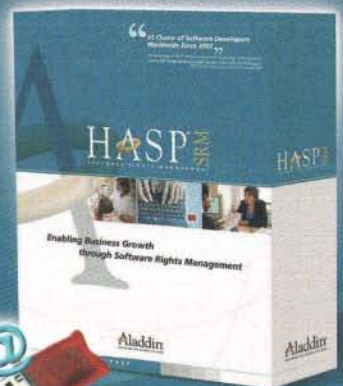
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A word of advice: The described method stores strings without any encryption. It is therefore not a secure way to store your sensitive information.

The following lines of JavaScript code declare two global variables, called *glassDoneButton* and *whiteInfoButton*, respectively. Each of the two variables holds one button. The first declaration creates the done button whereas the second declaration creates that little info (i) button that you frequently see in Widgets.

```
var glassDoneButton;  
var whiteInfoButton;
```

The following JavaScript code implements the two button definitions:

```
glassDoneButton = new  
AppleGlassButton(document.getElementById("doneButton"),  
"Done", hidePrefs);  
whiteInfoButton = new  
AppleInfoButton(document.getElementById("infoButton"),  
document.getElementById("front"), "white",  
"white", showPrefs);
```

The following command line output text explains where Dashboard keeps the Widget stored information using the described method:

```
mtsouk$ ll ~/Library/Preferences/widget-  
com.mtsouk.widget.saveprefs.plist  
-rw----- 1 mtsouk mtsouk 98 May 18 22:13  
~/Users/mtsouk/Library/Preferences/widget-  
com.mtsouk.widget.saveprefs.plist  
mtsouk$
```

The contents of the *widget-com.mtsouk.widget.saveprefs.plist* file are the following:

```
<?xml version="1.0" encoding="UTF-8"?>  
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN"  
"http://www.apple.com/DTDs/PropertyList-1.0.dtd">  
<plist version="1.0">  
<dict>  
  <key>OptionString</key>  
  <string>Option 4</string>  
</dict>  
</plist>
```



Figure 2: The final look of the presented Widget (both sides).

A word of advice: You can now understand why it is extremely important to have a uniquely defined *CFBundleIdentifier* key for every Widget that you create or use. The above *plist* file that stores the Widget preferences uses the

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`CFBundleIdentifier` value as a part of its filename. It is also important to have a **UNIQUE** `CFBundleName` key because if you try to install a Widget with the same `CFBundleName` key, Dashboard will ask you if you want to replace the existing Widget (the other, different Widget with the same `CFBundleName` name)!!

Conclusions

This article presents an advanced technique that lets you store and retrieve your Dashboard Widget preferences or any other data you like. The presented Widget uses the back side for selecting the desired preference and its front side for displaying it but you can choose to implement it any way you want.

Bibliography and References

Introduction to Dashboard Programming Topics:

http://developer.apple.com/documentation/AppleApplications/Conceptual/Dashboard_ProgTopics/Introduction/Introduction.html

Introduction to Dashboard Tutorial:

http://developer.apple.com/documentation/AppleApplications/Conceptual/Dashboard_Tutorial/Introduction/chapter_1_section_1.html

Developing Dashboard Widgets:

<http://developer.apple.com/macosx/dashboard.html>

Apple Dashboard Page:

<http://developer.apple.com/appleapplications/dashboard/>

Debugging Dashboard Widgets:

<http://developer.apple.com/technotes/tn2005/tn2139.html>

Dashboard Sample Code:

http://developer.apple.com/samplecode/AppleApplications/idxDashboard-date.html#/apple_ref/doc/uid/TP30000925-TP30000418-TP40001366

Disclaimer: The presented Widget code is a modified version of the "GoodBye" Widget provided by Apple and located on your Tiger machine (but not in Mac OS X 10.5), inside the `/Developer/Examples/Dashboard/GoodbyeWorld/3-SavingPreferences` folder. The "Save Prefs" Widget that is presented in this article has four options and, as you saw, it is a little bit more complicated than the "GoodBye" Apple Widget.



About The Author

Mihalis Tsoukalos lives in Greece with his wife Eugenia and enjoys digital photography and writing articles. He is the author of the "Programming Dashboard Widgets" eBook. You can reach him at tsoukalos@sch.gr.

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Packaging Special Payloads with PackageMaker

Bringing drivers, libraries, and plug-ins to the OS X target

by José R.C. Cruz

Introduction

One task that some developers face is to deliver special payloads such as device drivers, frameworks, and codecs to their users. Unlike applications or files, these payloads must reside in specific locations on the target system. They must have the right settings for permissions, UID, and GID. Some payloads require specific hardware to operate. Some require authentication or a specific post-install action.

In this article, we will explore the issues behind delivering these special payloads. First, we will list each payload and look at how to handle each one. Then, we will learn how to check for specific hardware on the target system. Next, we will build a demo package with three payloads, two of which are special. We will then test this package and study its behavior.

As always, the installer project featured here is available from the MacTech website. To get a copy of the project, go to the following URL:

ftp.mactech.com/src/mactech/volume24_2008/24.10.sit

The Special Payloads

As stated earlier, special payloads need special handling. To correctly install this payload, first know what its needs are and how to address them. Doing so will help avoid any post-install issues such as system hangs, freezes, or even a kernel panic.

The following are three basic groups of special payloads that you will encounter most. Some payloads do not fit into any these groups, but those are few and far between.

Drivers

The job of a driver is to add or extend system functionality. Drivers in OS X are often in the form of a kernel extension. You can place the driver inside an application bundle or in the directory `/System/Library/Extensions`. If the latter, prepare each driver as follows.

- First, set the bundle's UID and GID to root and wheel.

Make sure to use the same UID and GID to the bundle's subdirectories and component files.

- Next, set its permission flags to `rwxr-xr-x`. Use the same flags for the bundle's subdirectories and executable items. For the component files, however, use the flags `rw-r-r-`.

Now some drivers work only if the target system has the correct hardware. Others need the system restarted in order to become active. Lastly, since access to `/System/Library/Extensions` is restricted, users must authenticate the install session.

Libraries

Libraries carry code and data that provide services to various OS X applications. They can come in several formats, with the most common being the framework bundle.

There are several places wherein to store a framework. Choosing which one to use depends on the framework at hand. For most frameworks, use the directory `/Library/Frameworks`. This location gives all applications access to the framework code. To limit access only to applications that the user owns, use the directory `~/Library/Frameworks`. Both directories are public and as such do not need users to authenticate the install session.

For frameworks that provide system-wide services, use `/System/Library/Frameworks`. For those meant only for in-house or private use, use the location `/System/Library/PrivateFrameworks`. Both locations, however, will require users to authenticate the install session. Also, Apple reserves the right to modify either location during every OS X upgrade. Make sure to provide a way to backup any custom frameworks in these locations.

Frameworks that go into the `/Library` or `~/Library` locations can use the user's login name and admin as their UID and GID. Those that go into the `/System/Library` locations must use root and wheel. As for permission flags, use `rwxr-xr-x` for the framework, its subdirectories, and its binary files.

For any text files inside the framework, set their permission flags to `rw-r-r-`.

Other libraries use a proprietary file format. They also have their own locations on the target volume. For instance, Python packages use either `/Library/Python` or `~/Library/Python` as their locations. Perl modules, on the other hand, go into either `/Library/Ruby` or `~/Library/Ruby`. And POSIX libraries use the “invisible” directory `/usr/lib`. The UID and GID for these libraries are `root` and `wheel`. Their permissions flags are always set to `rw-r-x-r-x`.

Plug-ins

Plug-ins add custom features or functions to a software client, which can be either an application or a system service. The client loads a plug-in on demand and after its host system has booted up.

Most plug-ins go in specific directories inside either `/Library` or `~/Library`. Each plug-in directory is named after the plug-in service or after the plug-in’s client. For instance, `osax` plug-ins, used by the AppleScript runtime, go into the directory `ScriptingAdditions`. QuickTime codecs use the similarly named `QuickTime` directory. Preferences panels are stored in the `PreferencesPanels` directory. And Dashboard widgets go in the `Widgets` directory. Consult your project guidelines for the correct directory for your plug-ins.

Also, most plug-ins use the user’s login name as their UID, and `admin` as their GID. As for permission flags, these vary

with the type of plug-in. For example, `osax` plug-ins use `rw-rw-rw-` for their bundle directories and files. QuickTime codecs use `rw-r-xr-x` for its subdirectories and binary files, but `rw-r-r-` for its support files. Again, check your project guidelines for the correct settings.

Checking For Hardware

As stated earlier, some special payloads need the right hardware present on the target platform. So, if you let the package to check the target’s hardware, you can reduce the number of unwanted files stored on the target. Fewer unwanted files means more space to store user data. It also means a leaner and more responsive system.

You can perform the hardware check in a number of ways. One way is to use one of the preset conditions in the Requirements Editor. Another way is to use a script to do a `sysctl` query. A more elegant way is to query the IOREgistry with JavaScript.

Using preset conditions

Figure 1 shows the two sets of conditions that you can use for a hardware check. When creating a package with PackageMaker, choose the Requirements tab to specify requirements that this package must meet. The first set (shaded in green) focuses entirely on the host’s hardware traits. To use one of the conditions, first select them from the `If` pop-up menu. Then choose the Boolean operator from the `is` menu.



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Next, enter the desired value to the field provided. Or if the condition provides a menu of Boolean flags, choose the right flag from that menu.

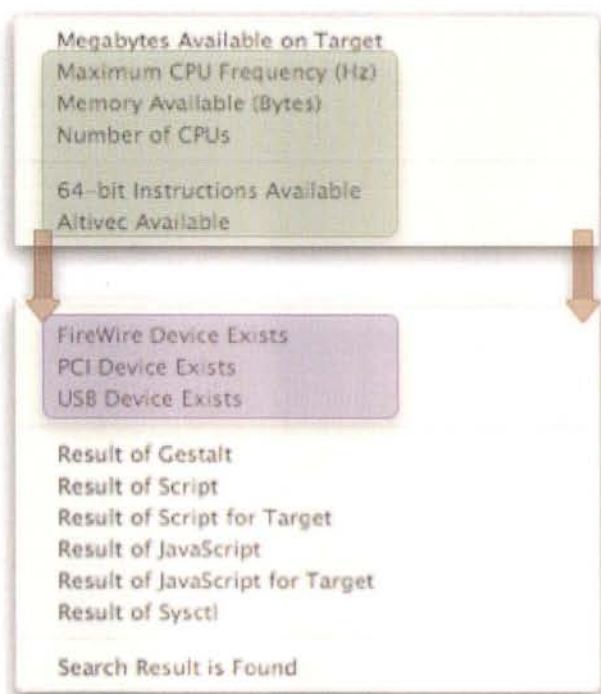


Figure 1. The preset conditions for hardware checks

For example, Figure 2 shows two hardware checks using the preset conditions. The one on the left checks to see if there are at least two CPUs present. And the one on the right checks if the hardware supports 64-bit instructions.

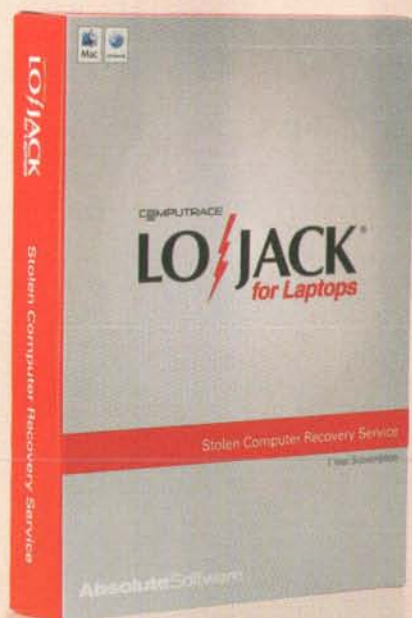


Figure 2. Two sample hardware checks

The second set of conditions (shaded in blue) focuses on devices attached to the host platform. Each condition looks for the device by examining one of three hardware buses: FireWire, USB, and PCI. If the device is present on the bus, the condition returns a TRUE; otherwise, it returns a FALSE.

To illustrate, assume your payload uses the FlashGO! USB card reader from Imation Corp. To look for this device, setup the hardware check as shown in Figure 3. If the device is absent, the check can either disable the payload or display an error dialog. Note the name used in the **device** field. This is the name under which the device appears in the IORegistry. It is not always the same as the product name.

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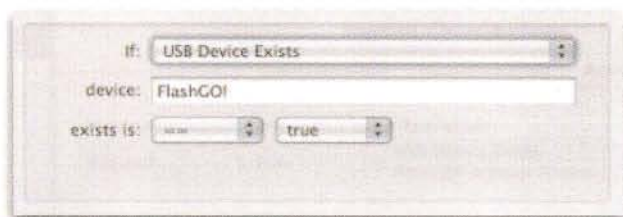


Figure 3. Checking for a USB device

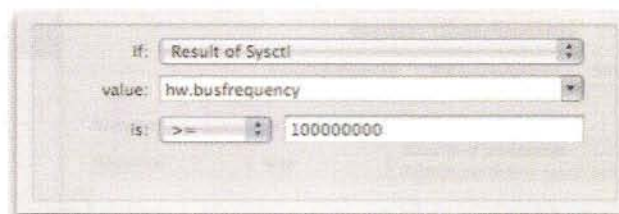


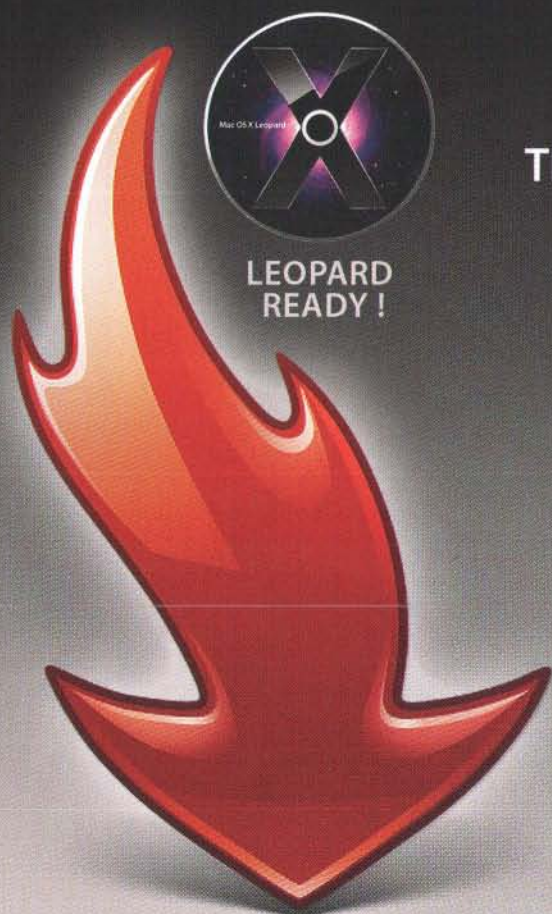
Figure 4. Checking the system bus frequency

Using `system.sysctl()`

You can also use the Requirements Editor to run a `sysctl` query. To do so, choose **Results of Sysctl** as the check condition. Enter the `sysctl` node and value in the fields provided, and then choose the Boolean operator from the **is** pop-up menu. For example, assume your payload works only if the host has a bus frequency of at least 100 MHz. For this check, setup the editor dialog as shown in Figure 4. Here, the `sysctl` node `hw.busfrequency` goes in the field labeled value. Then the `sysctl` value of 100000000 goes in the field next to the Boolean pop-up menu.

You can also add several `sysctl` queries using the Requirements Editor. The package, however, treats the check results in an all or nothing manner. If at least one `sysctl` check fails, then the entire group of checks also fails. For a more complex check logic, use a custom JavaScript function to do the query.

Listing 1 shows one example of such a function. This function first checks if the host platform has more than one CPU. If the check proves false, the function then checks if the CPU can handle 64-bit processes. Now if the CPU can handle 64-bit tasks, the function returns a `TRUE` when the CPU speed is greater than 100 MHz. But if the CPU handles only 32-bit tasks, the function returns `TRUE` only when the CPU speed is at least 200 MHz.



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Listing 1. Checking the hardware with system.sysctl()

```
function check_sysctl() {
    tCPU = system.sysctl('hw.ncpu');
    if (tCPU == 1) {
        tTyp = system.sysctl('hw.cpu64bit_capable');
        tClk = system.sysctl('hw.cpufrequency');
        if (tTyp = 1)
            return (tClk > 1000000000);
        else
            return (tClk > 2000000000);
    }
    else if (tCPU > 1)
        return true;
    else
        return false;
}
```

To use the above function, first add the script to the project's Script Repository. Then choose **Result of JavaScript** as the check condition. Enter the function's name into the function field. Set the Boolean operator and value as shown in Figure 5.

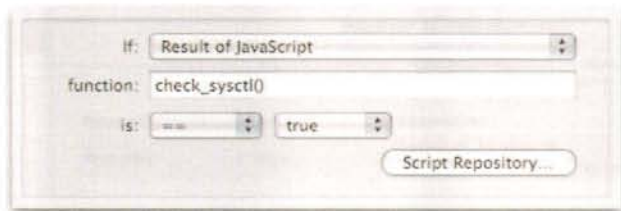


Figure 5. Calling the custom function check_sysctl()

Checking The IORegistry

Sometimes, you want hardware checks that are difficult to do using either a preset condition or a sysctl query. So to do these checks, you will access the IORegistry directly. The IORegistry is a database of services nodes on OS X. Each node can be an active hardware or driver. The IORegistry is also dynamic by design. It updates its list of nodes each time hardware or driver is added or removed. Equally important, the IORegistry shows how the nodes related to each other.

Viewing the IORegistry

To view the IORegistry, use the Xcode utility tool **IORegistryExplorer**. This tool displays the entire IORegistry as a hierarchical tree on the left panel (Figure 6). Selecting a node on the tree displays that node's properties on the right panel. Nodes that have a triangle widget have *child nodes* under it. Clicking the widget hides or shows the children for that node.

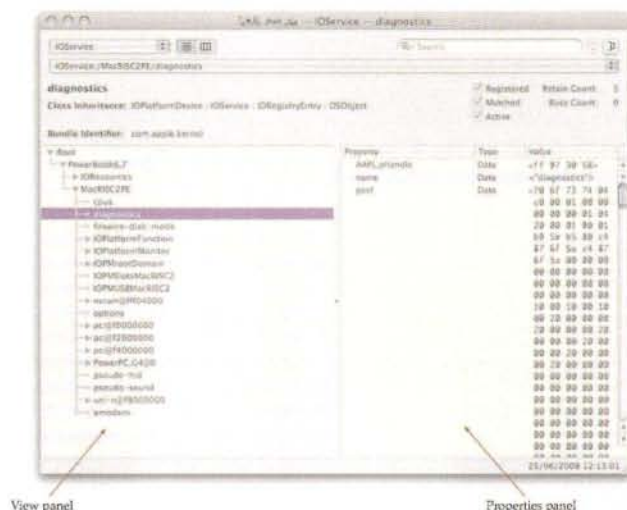


Figure 6. Main window of the IORegistry tool

The top pane on the window controls how the tool displays the IORegistry. By default, the tool shows all the active nodes on the tree. To view only nodes that belong to a specific category, choose the category from the upper-left pop-up menu (Figure 7). Your choices include *IODeviceTree (default)*, *IOFireWire*, *IOPower*, and *IOUSB*. Also, as stated earlier, the tool uses a hierarchical tree to view the IORegistry. To switch to a columnar view, click the second button near the upper-left corner.

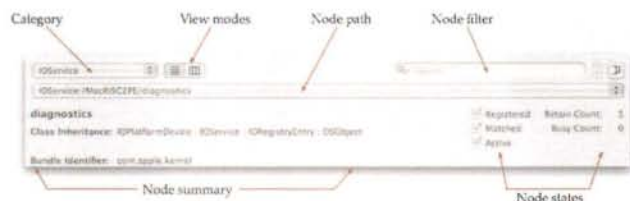


Figure 7. Controls on the IORegistryExplorer tool

The second pop-up menu displays the absolute path of the selected node on the IORegistry. If there is only one instance of the node, this menu displays only one path. But if there are multiple instances of the same node, the menu will show multiple paths. For example, on the iBook/G4 system, selecting the node **CHUDProf** displays only one path.

`IOService:/IOResources/CHUDProf`

But selecting the **IONetworkStack** node displays four possible paths (Figure 8). Here, a checkmark precedes the path of the selected node. Each instance of **IONetworkStack** belongs to a different network device. Selecting the path to each instance also selects that node on the IORegistry.


```

✓ IOService:/IOResources/IONetworkStack
IOService:/MacRISC2PE/pci@12000000/AppleMacRisc...m43xx/AirPort_Brcm43xxinterface/IONetworkStack
IOService:/MacRISC2PE/pci@14000000/AppleMacRisc...et@1F/UniNEnet/IOEthernetInterface/IONetworkStack
IOService:/MacRISC2PE/pci@14000000/AppleMacRisc...alNode/IOFireWireP/IOFireWireInterface/IONetworkStack

```

Figure 8. Multiple instances of IONetworkStack

Finally, on the upper-right corner of the pane is the filter field. Use this to show only those nodes that have a certain string. Assume, for example, your target platform has a number of Macally hardware products. To display the nodes for those products, type the string "Macally" into the filter field. The tool then updates its IORegistry display as shown in Figure 9. Note the matching nodes are in bold, whereas their parent nodes are in grey text.

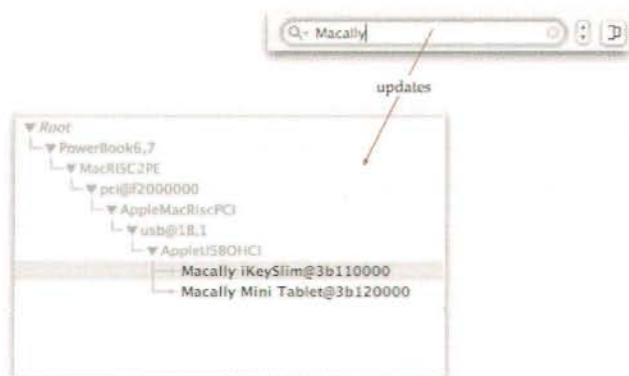


Figure 9. Filtering the IORegistry display

Querying the IORegistry

Use the `system.ioregistry()` property to query the IORegistry data from the installer package. This property is an instance of the JavaScript object, also named **IORegistry** (Figure 10). It is available only to the InstallationCheck phase of the install session.

IORegistry
<i>for internal use only</i>
<p>tree operations</p> <p><code>childrenOf(aPath):Array</code></p> <p><code>parentOf(aPath):Array</code></p> <p>search operations</p> <p><code>matchingClass(aClass, aPlane):Array</code></p> <p><code>matchingName(aName, aPlane):Array</code></p> <p>accessors</p> <p><code>fromPath(aPath):Array</code></p>

Figure 10. The IORegistry object

GraphicConverter 6

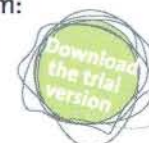


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The IORegistry object has three sets of functions, all of which return an associative Array as their results. Some functions take the node's name or class as input, but most take the *absolute path* to the node. You can get this path by using the IORegistryExplorer tool.

The first set of IORegistry functions returns *the parents or children of a specific node*. For example, assume you want to query the node `com_apple_driver_AudioIPCDriver`. To get a list of children for this node, use the `childrenOf()` function. Pass the absolute path to the node as the input string.

```
tChild = system.ioregistry("IOService:/IOResources/~
com_apple_driver_AudioIPCDriver")
```

To get a list of parent nodes, use the `parentOf()` function.

```
tParents = system.ioregistry("IOService:/IOResources/~
com_apple_driver_AudioIPCDriver")
```

If the node has neither children nor parents, both functions will return a NULL.

The second set of functions *searches for a node in the IORegistry*. They serve the same task as the filter field on the IORegistryExplorer tool. Use the function `matchingName()` to search for a node with a given name. Pass the name string as the function's input. For example, the snippet below searches for all nodes with the string "Macally".

```
tMacally = system.ioregistry.matchingName("Macally")
```

If, however, you want nodes belonging to a specific class, use the `matchingClass()` function. Again, pass the class name as the input string. To illustrate, the following snippet

will search for all FireWire nodes.

```
t1394 = system.ioregistry.matchingClass("FireWire")
```

If either search fails, the functions will return a NULL.

The third set consists one function that retrieves the *properties for a given node*. This function, `fromPath()`, takes one argument, which is the absolute path to the node. For example, to read the properties of the node `CHUDProf`, use the function as follows.

```
tCHUD =
system.ioregistry.fromPath("IOService:/IOResources/CHUDPro
f")
```

Again, if the node is absent, the function returns a NULL.

Now, you can read the Array elements in two ways. One way is to access each element via indices. Assume you want to examine all the child nodes of `AppleACPIPlatformExpert`. Listing 2 shows how you can do so using a `for` block. You can also use a `do...while` or a `while` block to do the same task.

Listing 2. Reading the children nodes of AppleACPIPlatformExpert

```
var tSib =

system.ioregistry.childrenOf("IOService:/AppleACPIPlatform
Expert");
if (tSib != null) {
    for (var tIdx = 0; tIdx < tSib.length; tIdx++) {
        var tNod = tSib[tIdx];
        // - process each child node
    }
}
```



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Another way is to iterate through each Array element using a `for...in` iterator. This method works best if the Array data is a list of properties. For example, assume you want to examine the properties of `CHUDProf`. Listing 3 shows how you can do so with the iterator.

Listing 3. Reading the properties of `CHUDProf`

```
var tDev =  
  
system.ioregistry.fromPath('IOService:/IOResources/CHUDProf');  
if (tDev != null) {  
    for (var tInf in tDev) {  
        var tProp = tDev[tInf]  
        // - process each node property  
    }  
}
```

Building The Package

In this section, you will build a basic installer package of special payloads. You will setup the package using the some of the information featured earlier. For a realistic touch, the payloads will be support software for the Macally USB product, the IceCad graphics tablet. These payloads are as follows.

- a configuration utility named `Macally IceCad.app`
- a StartupItem bundle named `TabletApp`
- a kernel driver named `TabletDrv.kext`

Due to copyright restrictions, the installer project will not include the Macally software. But you can get your copy of the software at the following URL.

<http://www.macally.com/en/Techsupport/Drivers.asp>

Adding payloads

Start by creating a new installer project. On the **Install Properties** dialog, choose 10.4 as the minimum target platform. You can also try 10.5, though you will find little, if any, change in behavior. For now, the rest of the article assumes a 10.4 target. It also assumes the payloads are inside a directory named `macally`.

Save the project file as `Foobar_Macally`. Click the package icon on the payload list to get the **Configuration** panel for the entire package. Update the panel as shown in Figure 11. Here, the package will display the **Custom Install** panel to the user. And it will allow users to choose a target volume for the payloads. Save your changes by choosing **Save** from the **File** menu.

Now click the **+** button on the lower-left corner of the payload list. Use the **Open File** dialog to go to the `macally` directory and to select the utility `Macally IceCad.app`. Click the **Choose** button to add the utility to the list. Then display the **Configuration** panel for that payload (Figure 12). Notice the payload gets `/Applications` as its destination. Change this to `/Applications/Macally IceCad.app`. Leave the rest of the panel at their default settings. Save your changes when done.

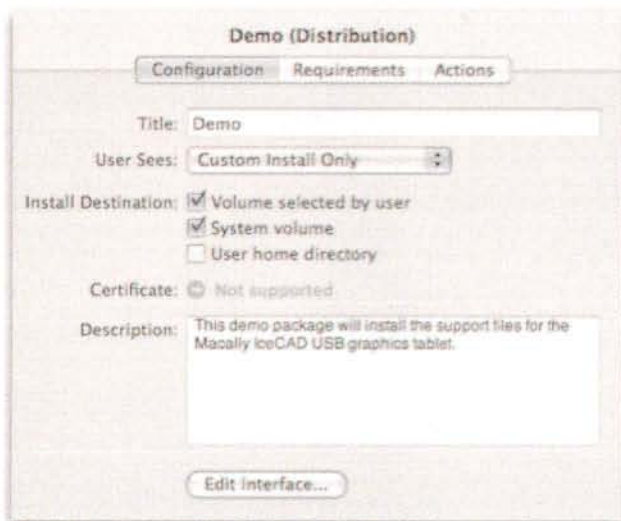


Figure 11. Configuring the entire package

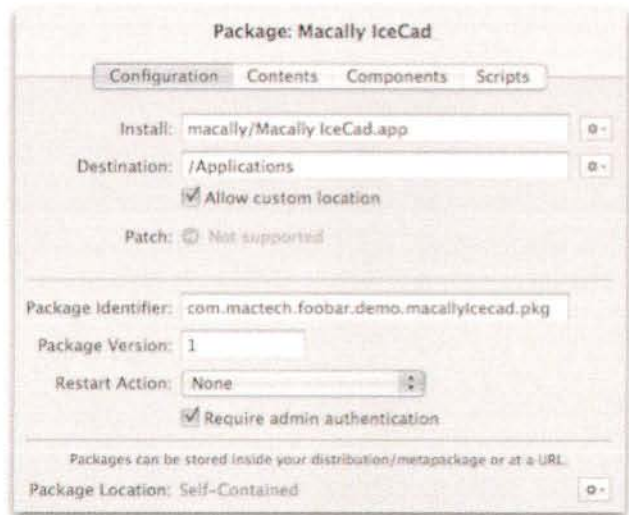
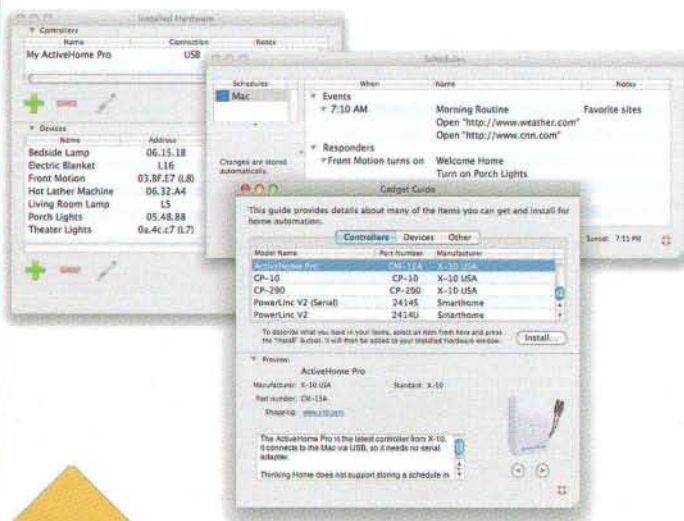


Figure 12. Configuring the application payload Macally IceCad.app

Click the + button again, and add the StartupItem bundle TabletApp to the project. Then bring up the Configuration panel for that payload (Figure 13). This time, the payload gets / as its destination. Since this is incorrect, change the path to /Library/StartupItems. Also, a StartupItem bundle must be

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loaded at boot-time. So, go to the **Restart Action** pop-up menu and choose **Require Restart** as the action. Leave the rest of the settings unchanged and save your changes.

Next, use the same steps to add `TabletDrv.kext` to the project. Then display the **Configuration** panel for this payload (Figure 14). Since the payload is a kernel extension, it gets `/System/Library/Extensions` as its destination. As that location has restricted access, make sure to set the checkbox **Require admin authentication**. But leave the restart action to **None**. OS X loads this extension only when it finds the Macally graphics table plugged in.



Figure 13. Configuring the StartupItem payload TabletApp

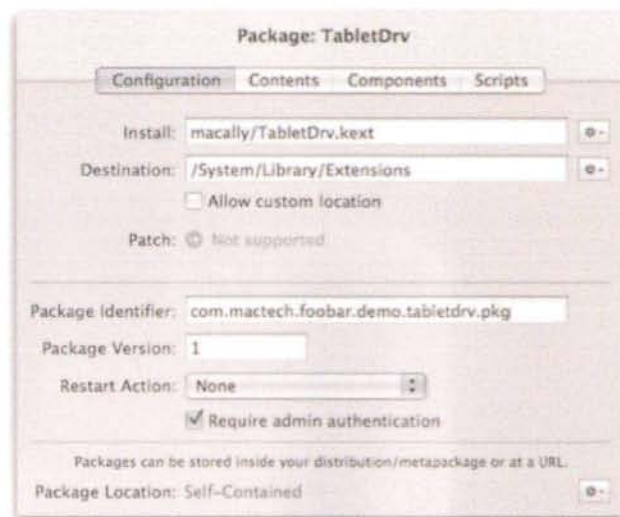


Figure 14. Configuring the driver payload TabletDrv.kext

Making checks

Next, you will add two simple checks to the package. Start by displaying the **Requirements** panel for the entire package. Then click the **+** button to get the editor dialog window. Update the dialog as shown in Figure 15. This check scans the USB bus for the Macally IceCad tablet. If the tablet exists, the check allows the install session to continue. Otherwise, it displays the specified error message.

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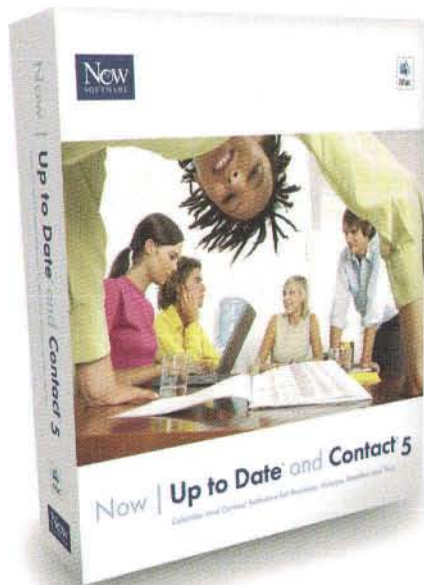
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To add the second check, select the choice for the payload `TabletApp`. Go to its **Configuration** panel and make sure the checkboxes **Selected** and **Enabled** are set. Now go to the **Requirements** panel for that choice. Click the **+** button to get the editor dialog. Update the dialog as shown in Figure 16. This check examines the system version of the target platform. If the system happens to be 10.4 or older, the check leaves the choice's state unchanged. Otherwise, it disables and deselects the choice. The reason for this check is that `StartupItem` bundles are now *deprecated* on 10.5, in favor of `LaunchAgents` and `LaunchDaemons`. Since the package also supports 10.4 targets, it must know when to correctly disable this choice.



Figure 15. Checking for the graphics tablet

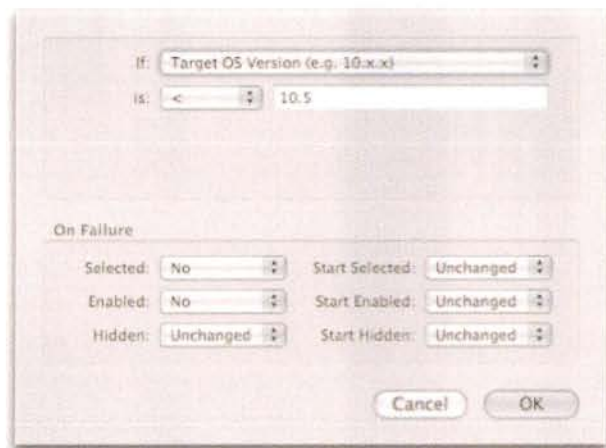


Figure 16. Checking for the target system

Setting up

Now it is time to set the permission flags, UIDs and GIDs of each payload. Start by selecting the payload `Macally IceCad` from the payload list. Then click the **Contents** tab to

display that payload's **Contents** panel. Click the triangle widget next to the payload's name. Repeat the same step until you see all the files contained in the bundle (Figure 17). Select all the files and directories by choosing **Select All** from the **Edit** menu.

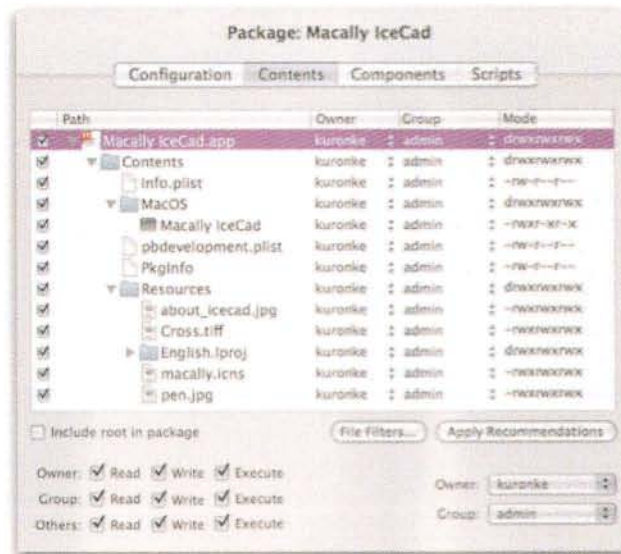


Figure 17. Setting the permissions, UID, and GID for `Macally IceCad`.

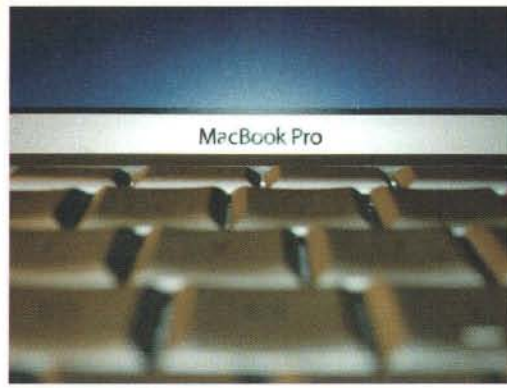
To set the payload's UID, choose `root` from the **Owner** pop-up menu. Conversely, let the GID be the default **Group** value of `admin`. Next, carefully select *only the directories and bundles* that make up the payload. Set the checkboxes **Read**, **Write**, and **Execute** for both **Owner** and **Group**. For **Others**, however, set only the checkboxes **Read** and **Write**. Use the same settings for the executable file inside `Contents/MacOS`. For the rest of the files, set the checkboxes **Read** and **Write** for both **Owner** and **Group**, but only the **Read** checkbox for **Others**. Save your changes when you are done.

Next, select `TabletApp` from the payload list. Use the **Contents** panel to display all the directories and files in that payload. Then choose **Select All** from the **Edit** menu. For the payload's UID, choose `root` from the **Owner** pop-up menu; for the GID, choose `wheel` from the **Group** menu. Then set the checkboxes **Read**, **Write**, and **Execute** for the **Owner**. But set only the **Read** and **Execute** checkboxes for both **Group** and **Others**.

Finally, select the payload `TabletDrv.kext` from the list. Go to its **Contents** panel and display all the items belonging to this payload. Select all the items and set their UID and GID to `root` and `wheel`. Next, select only the directories and bundles in the payload. Set the checkboxes **Read**, **Write**, and **Execute** for the **Owner**, but only **Read** and **Execute** for the **Group** and **Others**. Now select just the files in the payload. Set the checkboxes **Read** and **Write** for the **Owner**, but only **Read** for **Group** and **Others**. Save your changes immediately.

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Package testing

You are now ready to test your installer package. Start by choosing **Build and Run** from the **Project** menu. When prompted for a package name, enter the name `Macally_Demo`. PackageMaker then builds a distribution package with the three payloads. It sets the correct permissions, UID, and GID for each payload. Once done, it tells the Installer core utility to open the package and start the install session.

At the start of the session, the first panel you see is the **Welcome** panel (Figure 18). But this panel appears only when the target has the IceCad graphics tablet attached. If the tablet is absent, an error dialog appears on top of the panel (Figure 19). Clicking the **Close** button then ends the install session.

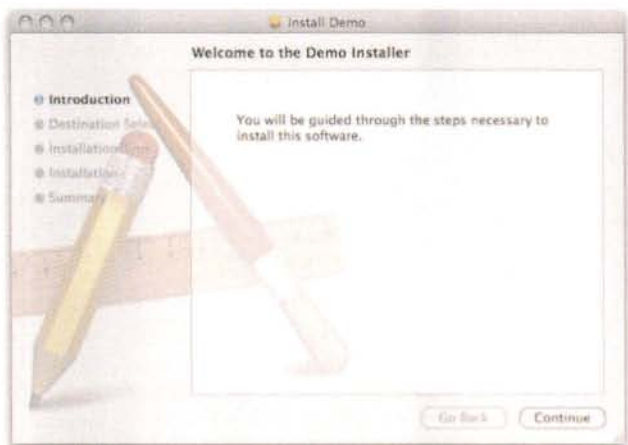


Figure 18. The Welcome panel

You can disable the **InstallationCheck** phase if you do not have the right graphics tablet. First, bring up the check for the tablet into the **Requirements Editor** (see Figure 3). Then change the check results from **TRUE** to **FALSE**.

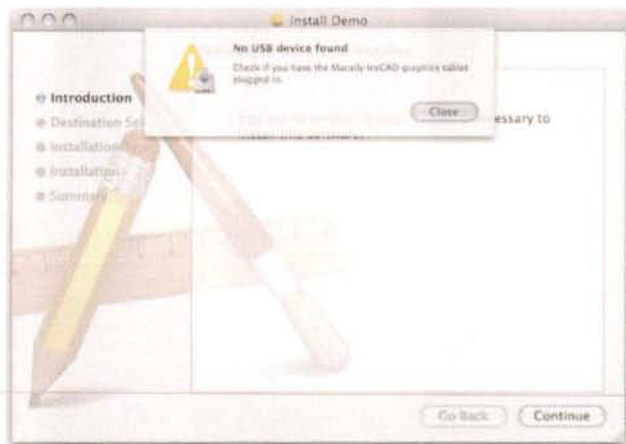


Figure 19. When the IceCad tablet is absent

Let us assume that you do have the graphics tablet. Click the **Continue** button to switch to the **Destination Select** panel (Figure 20). Note the panel presents two possible locations for the payload. For this test, select the *first location* on the list. Click **Continue** to proceed to the **Custom Install** panel.

BUG ALERT:

Sometimes, the package will not display the **Destination Select** panel, proceeding instead to the next panel. This happens even if there are several mounted volumes and the package allows users to choose one of the volumes as the target. This appears to be a bug in version 3.0.1 of the Installer utility. It is unknown if this same bug is present in later versions.

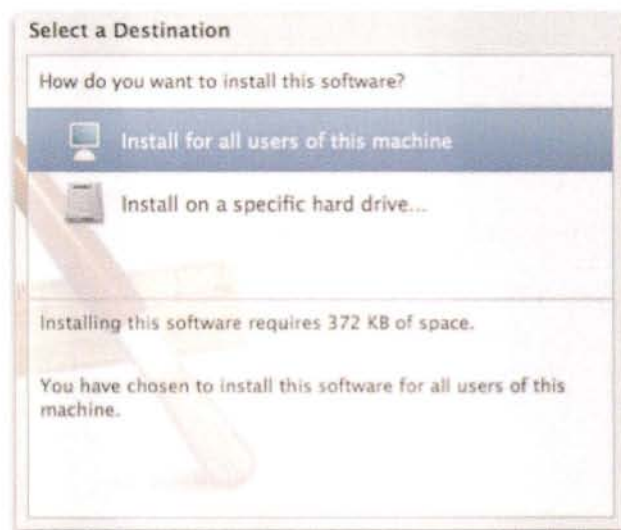


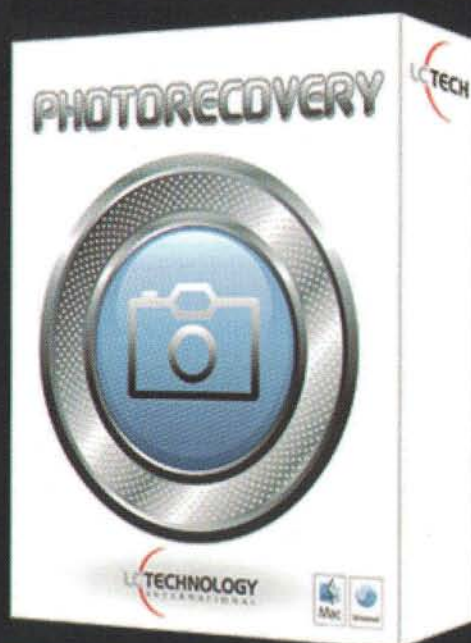
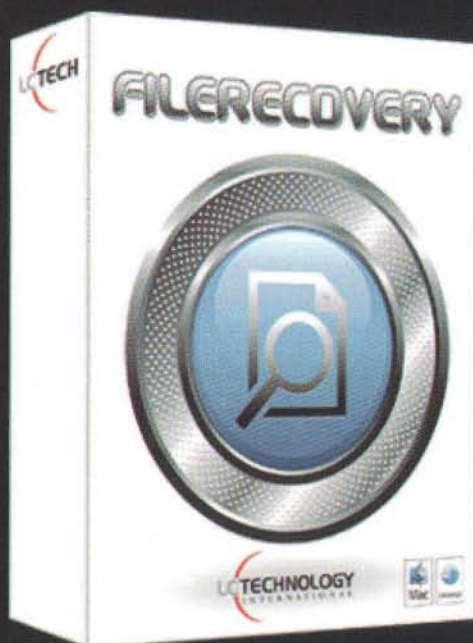
Figure 20. Choosing a destination

On the **Custom Install** panel (Figure 21), you will see a list of three payload choices. Note the second choice, `TabletApp`, is disabled and unselected. In this case, the host system happens to be Leopard (10.5). If the host uses Tiger (10.4), the `TabletApp` choice will be both enabled and selected by default.

Leave the selections as is and click the **Install** button. First, the package prompts you to authenticate the install session. Then it installs the two selected payloads onto their respective locations. Once it displays the **Conclusion** panel, choose **Quit Installer** from the **Installer** menu. Switch to the **Finder** and locate the `/Applications` directory. In there, you will find the utility `Macally IceCad.app`. Now go to the directory `/System/Library/Extensions`. Here, you will find the kernel extension `TabletDrv.kext`. Select each installed payload and choose **Get Info** from the **File** menu. Examine the UID, GID, and permission flags for each payload. They should match the ones you have set in the **Contents** panel for each payload.

Finally, go to the directory `/Library/Receipts`. Here, you will find two receipt bundles, one for each installed payload. Now if you built package using the new flat-file

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format, you will not find any receipts for your payloads. Instead, the Installer tool will log the session in its private database named `areceipt.db`. This makes verifying and undoing an installation more challenging. But that is a topic for another time.

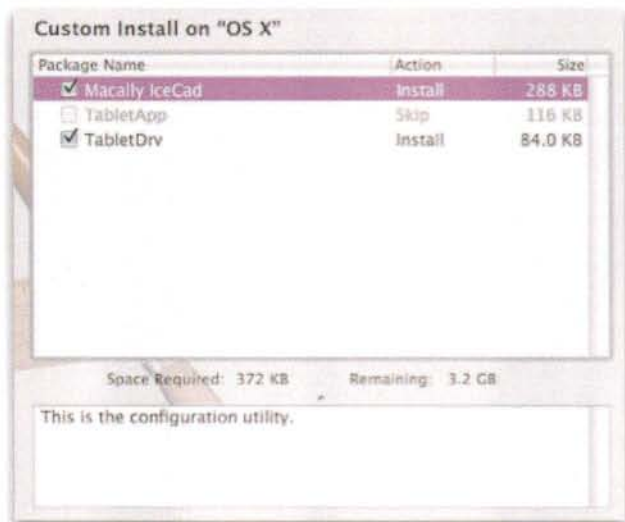


Figure 21. A list of payloads

Concluding Remarks

Special payloads need extra handling when added to an installer package. Otherwise, they may cause problems in the

target if they are installed incorrectly. Some payloads need to be in the right location on the target. Some need the right hardware present. Some must have the right permissions set, others the right UID and GID. PackageMaker 3 gives you the means to address these needs. You can set the right permissions, UID, and GID of each payload via the **Contents** panel. You can use the Requirements Editor to add a simple hardware check or an external script to do complex checks. And you can set the right location and restart action on each payload's **Configuration** panel.

In the next article, I will explore the concept of an installer plug-in. I will show how to write a simple plug-in and add it to an installer package. Until then, I bid you well.

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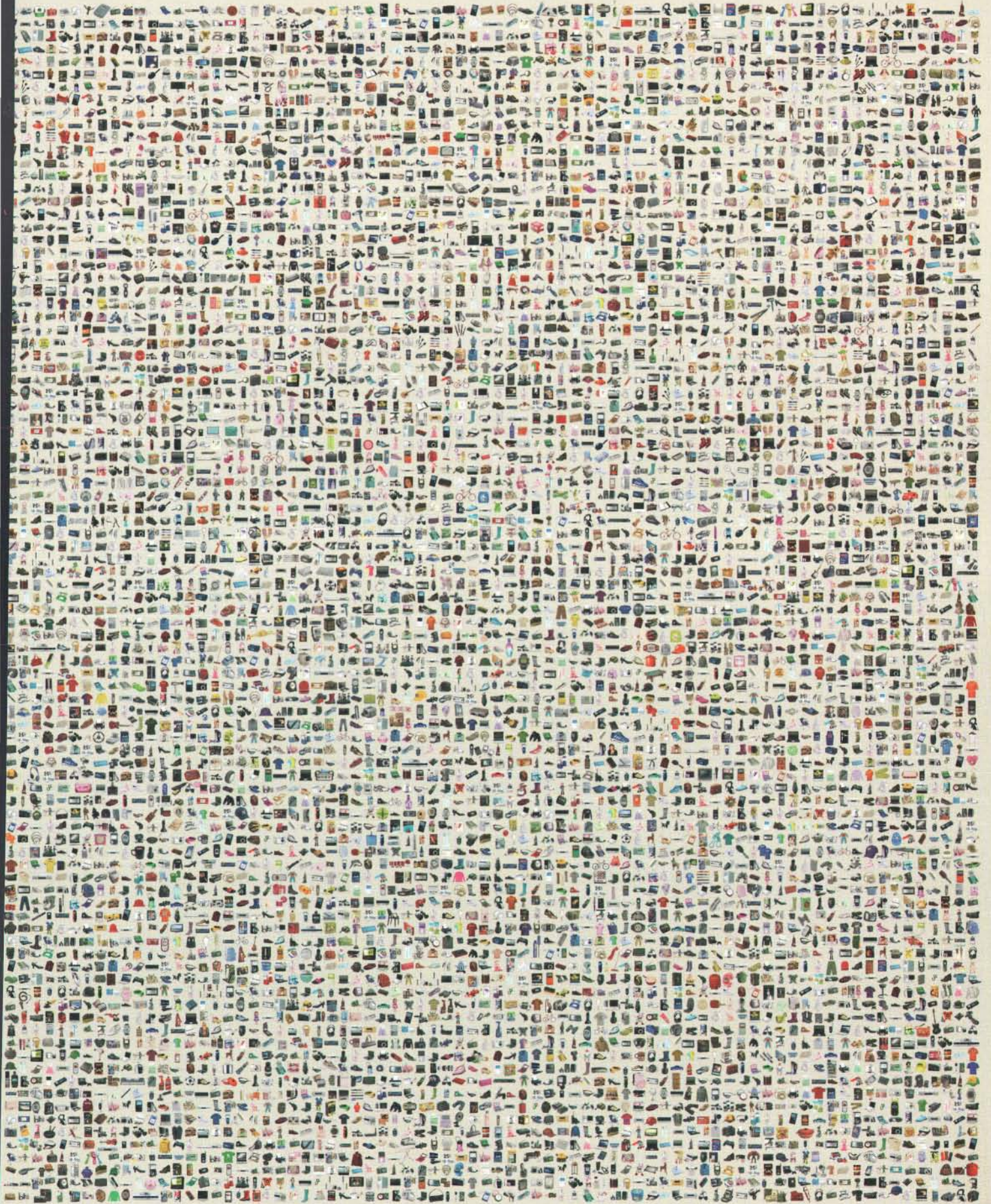
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Microsoft Expression Media 2

by *Dennis Sellers*

Along with the release of Office 2008 for the Mac earlier this year, Microsoft's Macintosh Business Unit (best known as the Mac BU) also released a Mac version of Expression Media 2. If you need to visually catalog and organize media elements, you'll find the software useful.

With Expression Media 2—based on the iView MediaPro software Microsoft bought in June 2006—you can create visual databases (or “catalogs”) of media containing references of up to 128,000 files per catalog. You can store the catalogs just about anywhere (on shared folders, CDs, hard drives, DVDs, etc.) and use integrated search tools within Expression Media to keep track of them.

Like all well-behaved Mac apps, Expression Media 2 supports drag and drop. You can drag and drop documents, images, fonts, and more into a thumbnail-based visual catalog. Expression Media 2 implements hierarchical tagging and supports file system integration features, such as automatic synchronization and folder watching. You can search and sort media by a variety of criteria—and even rename media files and folders directly within the software.

Expression Media 2 supports standard metadata formats like EXIF, IPTC, and XMP, as well as Nikon D40X, Sony's A100 RAW format (for geotagging functionality) and Microsoft's emerging JPEG-XR standard—and can generate a thumbnail for most of them. Data can be exported into a variety of formats, as well.

The software offers five different views for reviewing images, listening to music or watching movies: List, Thumbnail, Media, Lightbox and Slide Show. You can also choose up to six files to compare side-by-side in full screen view.

The Image Editor lets you perform a variety of editing tasks, such as cropping, red-eye removal, creating duotones and adjusting color balance. There are also several built-in auto enhancements for touching up images, as well as support for built-in color profiles for keeping colors accurate and consistent across your workflow.

With Expression Media 2, you can extract and preview images from your digital files. And you can import or export, add or edit metadata from those files for searching and sorting.

Expression Media 2 lets you publish and distribute media with cross-platform slide shows, video, and web galleries. The software comes with several templates. You can use them as they

are — or tweak 'em to your heart's desire by modifying the timings, grids, transitions and audio playback.

After you've done a lot of work, you don't want to risk losing it. Expression Media 2 has features for archiving and backing up your media files, folders and catalogs to CD, DVD, hard disk or any mountable volume. Volumes can be unmounted after import, so you can use the Microsoft software to catalog CD-ROMs and other offline media.

Most of the software's features can be applied in a “batch” to different elements. Expression Media also has scripting capabilities that can be integrated with third-party application and tools.

Your media doesn't have to be online (e.g., in a mounted volume) to use the software. Even when your originals are offline, the software's visual catalogs allow you to browse, search, and annotate your assets.

Your work can be viewed by anyone who has the cross-platform, free Expression Media Reader. You can also output to outputting to contact sheets and web galleries. A recent update also added multi-monitor Light Table support. This means you can have the Light Table (for processing and rating images and other files) open on one monitor while the catalogue and tools are open on another.

Microsoft's Expression Media feature does a bit of a dance around something that's already accomplished by iPhoto or Aperture, but incorporates it into the suite and allows the user to employ some basic web graphics and simple photo manipulation. This is something that may be useful if you are using a workflow, particularly that integrates with the Microsoft Office 2008 workspace.

Expression Media 2 is for Expression Media 2 is available either separately for \$199 or as part of the full Expression Studio 2 for \$699. The Studio bundle also includes Expression Web 2 (a web site design tool), Expression Blend (a design tool for creating user interfaces), Expression design (an illustration and graphic design tool), and Expression Encoder (which lets you import and encode video files, produce live webcasts, enhance media with watermarks and advertising, and publish with Microsoft Silverlight).

Qualifying iView MediaPro customers and owners of other qualifying products, can upgrade to Expression Media for \$99. Expression Web, Expression Blend, Expression Media & Expression Studio customers can upgrade to the full Expression Studio 2 for \$349. A fully featured 30 day free trial for Expression Media 2 is currently available for download here: <http://www.microsoft.com/expression/try-it/default.aspx>

Then there's Office 2008 for Mac Special Media Edition (which lists for \$499.99), which is a bundle of the standard edition of Office and Expression Media 2.

Expression Media 2 requires Mac OS X 10.4 or 10.5. It's a Universal Binary, so it runs natively on both PowerPC and Intel Macs. If you're using it with 10.5 (“Leopard”) you can preview your files without opening them thanks to support of the QuickLook technology.



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Kerio Mail Server

by Dennis Sellers

Kerio MailServer, an email groupware solution from Kerio Technologies, now natively supports iPhone functionality to accommodate the small to medium sized business market. Considering the hoopla surrounding—and the high sales of—the iPhone 3G it's a timely update.

Kerio MailServer was first launched in 2002 on Windows and Linux, with the Mac version following the next year. Two years into the game, Kerio added new features and began work on Microsoft Outlook support. Today what you get with MailServer is a mail server with integrated spam features, dual antivirus controls, the ability to archive back-ups and a long list of supported clients and devices.

With the latest version, owners of the original iPhone and the 3G model can take advantage of the benefits of push email, push contacts and push calendar as well as remote wipe. Kerio MailServer lets you synchronize email, contacts and calendars with the iPhone natively over the air with the Microsoft Exchange ActiveSync protocol. Kerio's messaging server syncs data wirelessly with the iPhone 2.0 software update.

Kerio was able to take advantage of the existing Exchange package support and tweaked it to make ActiveSync work with the iPhone. Dusan Vitek of Kerio Technologies says you'd think this would be a standard protocol, but each developer has integrated it a bit differently. This means Kerio has to test each device independently to make sure MailServer works as seamlessly as the company wants it to.

"Microsoft hasn't made it easy," he adds. "In fact, there are two versions of ActiveSync, and both are called ActiveSync. There's one for desktop syncing and a wireless version. This was so confusing that Microsoft finally started calling the wireless version Exchange ActiveSync. There are different generations of the product, which jumped from version 2.5 to version 12 with the introduction of Exchange 2007."

Though the latest version of Kerio MailServer touts iPhone 3G and iPhone 2.0 support, the first generation iPhone will work with it as well — if you upgrade the firmware. Actually, Kerio has supported the iPhone for about a year, but had previously implemented a less graceful way of syncing data (though it was the only available way at the time). By the way, one of the benefits of ActiveSync is that if your device is lost or stolen, a remote command can be issued that essentially resets the device.

With Kerio MailServer, customers can choose any client, including iCal, Address Book or Microsoft Entourage on Mac OS X or Microsoft Outlook on Windows, to integrate email, calendars and contacts. The iPhone and other smartphones—including Windows Mobile, Palm, Symbian, and Blackberrys—connect wirelessly to Kerio MailServer. Which means, of course,

that you can keep everyone in sync (no pun intended) in your company.

Kerio's collaboration server delivers groupware with anti-virus and anti-spam protection, integrated automatic backup and archiving. MailServer is the only Exchange alternative to natively support Microsoft Entourage in Exchange mode. What's more, it offers a migration tool for those considering moving from Microsoft Exchange.

It's also easy to set up. There's a QuickStart wizard that helps you through the process. It asks for your administrative password, mail domain names, etc., then gets to work.

MailServer's Administration Console is a user friendly Mac OS X application. You can control all of MailServer's features through the console, which can be installed on a remote machine. This means that administrators don't have to be on-site to monitor the server and make any necessary changes.





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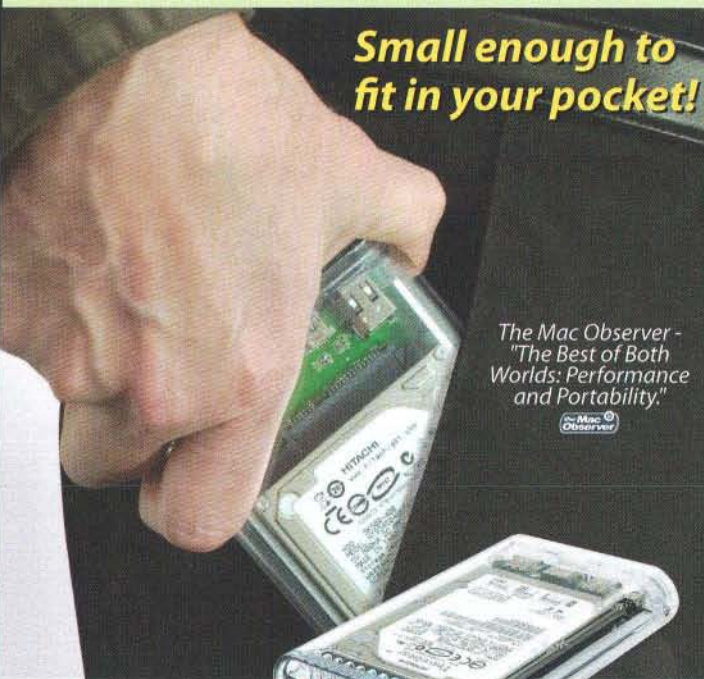
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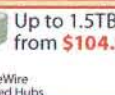
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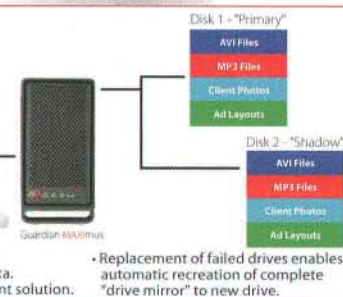


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MailServer consists of three main components, with the engine running as a background task, while a service monitor utility and administration console provide a status check and access for configuration. In addition to its own Web Mail client, Kerio supports Microsoft Outlook and Entourage (on Macs) for e-mail and groupware. For Outlook, it requires that the Kerio Outlook Connector be installed on each client. The Outlook support requires online connection to the Kerio server; otherwise another product, Kerio Synchronization plug-in, is necessary to provide local Outlook storage for offline operation.

If you compare MailServer to Microsoft Exchange, they're quite similar to a point—the biggest difference between the two is that MailServer is more flexible. For example, the Exchange server will only run on a Windows Server OS, which may not be your company's operating system of choice. Kerio MailServer will also run on Mac OS X or Linux. In addition to the server versions of these operating systems, it can also run on desktop versions. Kerio says you should use the version of an OS that you're most comfortable with, but the more users you're serving, the more robust server set-up you should implement.

Another differentiator between MailServer and its competitors is that Kerio provides an iCal server. Since Apple started pushing iCal as a protocol, Kerio wanted to "play nice" with the set-ups of those people who manage their calendars using iCal, says Vitek. MailServer does just that, even with those who using a PC with, say, Outlook. Of course, Mac OS X has

no support for Outlook, so Kerio MailServer serves as a bridge between these worlds, translating different formats of calendar invitations and pushing them to individual mobile devices. MailServer also syncs, in Exchange mode, with Apple's Address Book.

"Smaller companies typically don't settle on a unified platform or client device," Vitek says. "On the other hand, large companies often enforce some type of policy. We know support for a variety of smart phones, different clients and different operating systems are important to our market and our customers."

MailServer is sold with a "perpetual license." Pricing — which starts at \$499 — includes 12 months of tech support via email and phone and 12 months of software maintenance. Customers with active subscriptions can get the latest update for free. More info at:

http://www.kerio.com/kms_iphone_sync.html

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About The Author

Dennis Sellers is a long time journalist. He started in the newspaper business, but has been in the online journalism business for the past 15 years. He's the editor/publisher of Macsimum News (<http://www.macsimumnews.com>)



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THE MACTECH SPOTLIGHT

Matthew Drayton

Nolobe Pty Ltd.

What do you do?

I am the CEO and lead developer at Nolobe.

How long have you been doing what you do?

I've been a Mac developer for close to 8 years. I started after completing my Computer Science degree in 2000. I went to work for Peter N. Lewis at Stairways Software where my main responsibility was the development of Interarchy.

At the start of 2007 I formed my own company and purchased the rights to Interarchy from Peter. It was essentially an employee buyout.

What was your first computer?

My first computer was an Apple IIc. I have a lot of fond memories of that computer. It was the computer I first learnt how to program on. My first Mac was my second computer, a LC II.

Are you Mac-only, or a multi-platform person?

We are Mac-only. I've never had any desire to develop for any other platform.

What's the coolest thing about the Mac?

I think the coolest thing about the Mac today is the Unix underpinnings. I love that I have a Unix workstation in front of me, and I love that I am completely shielded from it. I don't need to go anywhere near the Unix underbelly unless I want to.

What is the advice you'd give to someone trying to get into this line of work today?

It is important to first figure out what your goals are - fame, fortune, job, etc - and then move in that direction. I wanted to earn a living writing Mac software so I sought out Peter N. Lewis. He gave me a job and taught me everything he knew about Mac development. Today I have my own company doing what I love.

What's the coolest tech thing you've done using OS X?

I'm not sure this answers the question, or if anyone else will think it is cool, but I do. Lots of people think Interarchy is a Cocoa app. It isn't. In fact it is still largely written in Pascal. About once a month we will get an email from a customer congratulating us on rewriting Interarchy in Cocoa. I get a real buzz whenever one of these emails come in. It means we are doing something right.

Where can we see a sample of your work?

You can download or read about our applications at <http://nolobe.com/>.

The next way I'm going to impact IT/OS X/the Mac universe is:

Currently we are working on updates to both Interarchy and Iris. I am particularly excited about the new version of Interarchy. It is going to have a very neat feature that takes advantage of the SSH file transfer protocol we added to Interarchy 9.0. We are also looking at getting into iPhone development but that is too far away to discuss.

Anything else we should know?

Interarchy (néé Anarchie) was first released on the 7th December 1993 meaning it will turn 15 later this year. That Interarchy has lasted this long is a real testament to Peter's ability as a Mac developer. I hope that I can keep it going for another 15 years.

MT

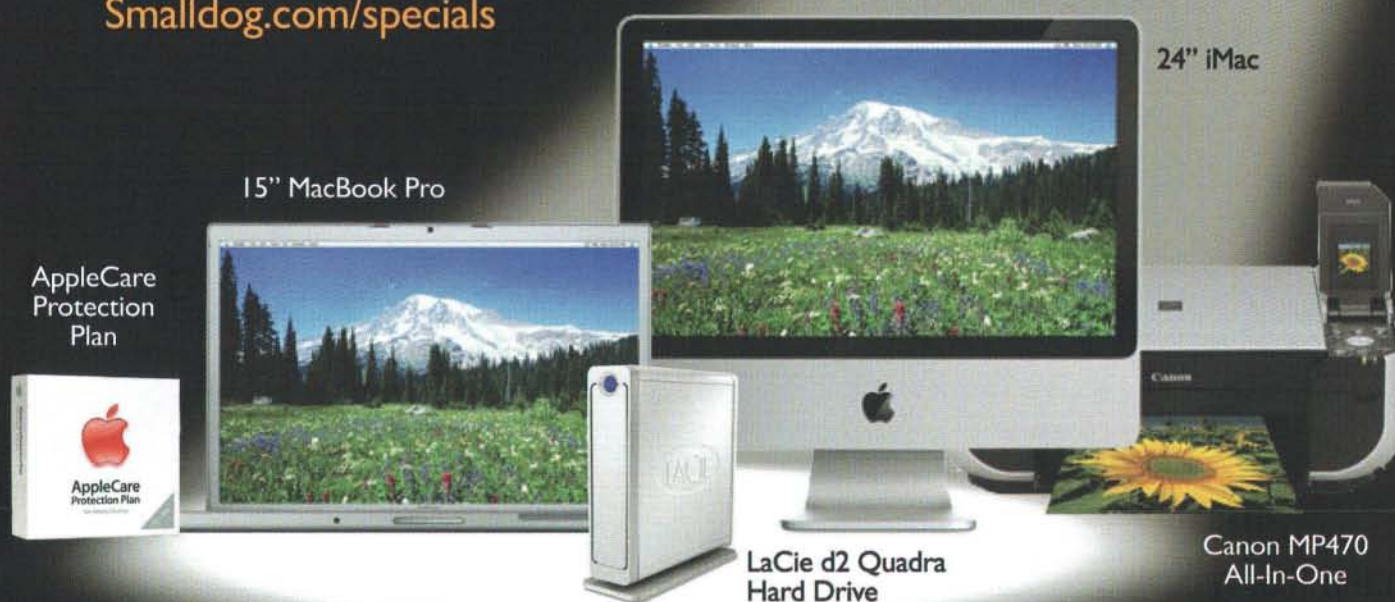
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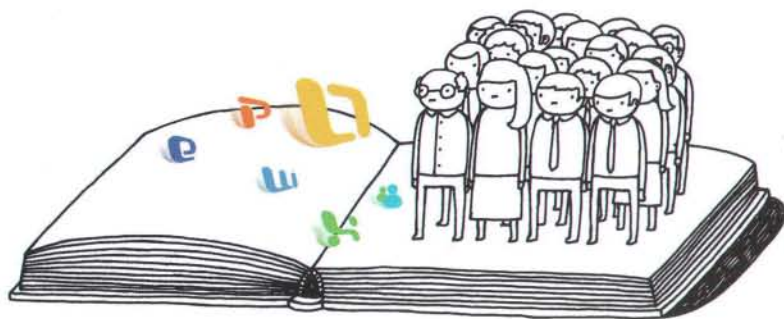
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